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THE INTERNATIONAL YACHT RACE.

Probably no former event in the history of yacht racing has attracted so much attention as the trial for the championship between British and American yachts in the vicinity of New York during the week commencing Sept. 7. The arrangements for the contest were not made without a great deal of correspondence, extending through many months. The race was for the possession of the prize cup won by the yacht America, in a contest with a fleet of British yachts off Cowes, England, in 1851; and its having remained on this side of the Atlantic for the thirty-four succeeding years as a standing challenge for British yachtsmen, made the latter extremely cautious in their preparations for an effort to win back the cup this year. The New York Yacht Club has held the cup under a deed of gift from the original owners of the America, under the condition of its remaining a perpetual challenge cup, not being the property of any boat winning a match in which it is the prize, but of the club to which such boat belongs, and subject to future competition for its possession. The New York Club, therefore, invited all regular organizations of American yachtsmen to unite with them in preliminary trials, with the view of selecting the best American yacht to defend the cup against the British yacht Genesta, which had been chosen to compete for it as the best representative "all-around" yacht of the different British yacht clubs.

When the challenges for this race were issued, it was quickly concluded that there was no centerboard sloop in this country of sufficient length to match against the Genesta, whereupon the flag officers of the New York Club ordered such a one built, and about the same time some members of the Eastern Yacht Club also ordered another, both being centerboard sloops. Of these two yachts, the Puritan, of the Eastern Yacht Club, was selected to sail against the Genesta.

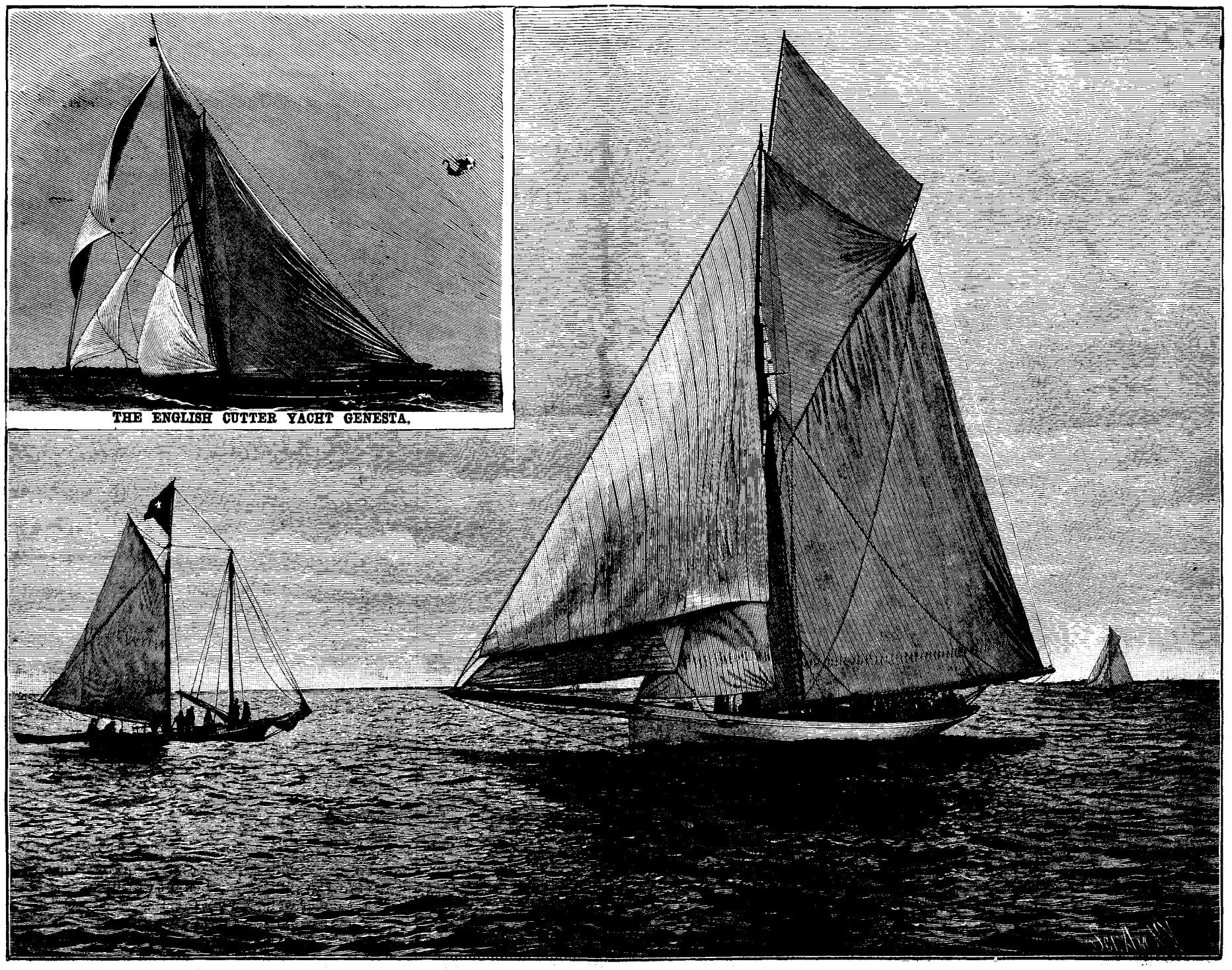
The Puritan is of wood, and was built at South Boston. Her dimensions are: 93 feet in length over all, 81 feet at the water line, 22 feet 7 inches extreme beam, and 8 feet draught. Mast, 78 feet long; topmast, 44 feet long; and bowsprit, outboard, 38 feet; main boom, 76 feet; gaff, 47 feet; and spinaker boom, 64 feet. All her spars are of Oregon pine. She was not selected for the trial until after a contest with the Priscilla, built by the New York yachtsmen, and minor changes in her sails, ballast, and some other details were being made up to within a few days of the race, every precaution being taken to have her in the best possible condition to creditably represent American yachting interests.

The Genesta, which has come over here to race for the cup, is owned by Sir Richard Sutton, of the Royal Yacht Club; she was designed by J. Beavor-Webb, and built on the Clyde, being of composite build, with steel frame and elm and teak planking. She is 96 feet long over all, 81 feet on the water line, 15 feet extreme beam, 11 feet 9 inches depth of hold, and 13 feet 6 inches draught.

The great differences in width and draught of the two yachts at once mark the broad distinction between the two classes of vessels, the Genesta being of the cutter, or "knife-blade," style, while centerboard sloops like the Puritan are sometimes styled in yachting vernacular "skimming dishes."

The particulars of the Genesta's spars are given as follows: Mast from deck to hounds, 52 feet; topmast from fid to sheave, 47 feet; extreme boom, 70 feet; gaff, 44 feet; bowsprit, outboard, $36\frac{6}{10}$ feet; spinaker boom, 64 feet; club of topsail, 42 feet. While the Genesta has not always been successful heretofore, she is to be credited with a long list of victories, under the most diverse conditions, since her first race, at the regatta of the New Thames Yacht Club, in the spring of 1884. Her passage across the Atlantic from Queenstown was made in twenty-four days under jury rig, that is, a mast and bowsprit two-thirds the length of her racing spars, and a small mainsail.

The cup won by the America in 1851, and which is the subject of the international contest, became the actual property of the owners of that schooner, as a prize won under the offer of the Royal Yacht Squadron of Great Britain, for which all nations were allowed to compete. It is of solid silver, ewer-shaped, and elaborately ornamented, standing two feet high and weighing over 100 ounces. Around its broadest part are medallions variously inscribed, the first inscription being: "One hundred guinea cup, won August 22, 1851, at Cowes, England, by yacht America, at the Royal



THE ENGLISH CUTTER YACHT GENESTA.

THE INTERNATIONAL YACHT RACE.—VIEW OF THE AMERICAN CENTERBOARD YACHT PURITAN.

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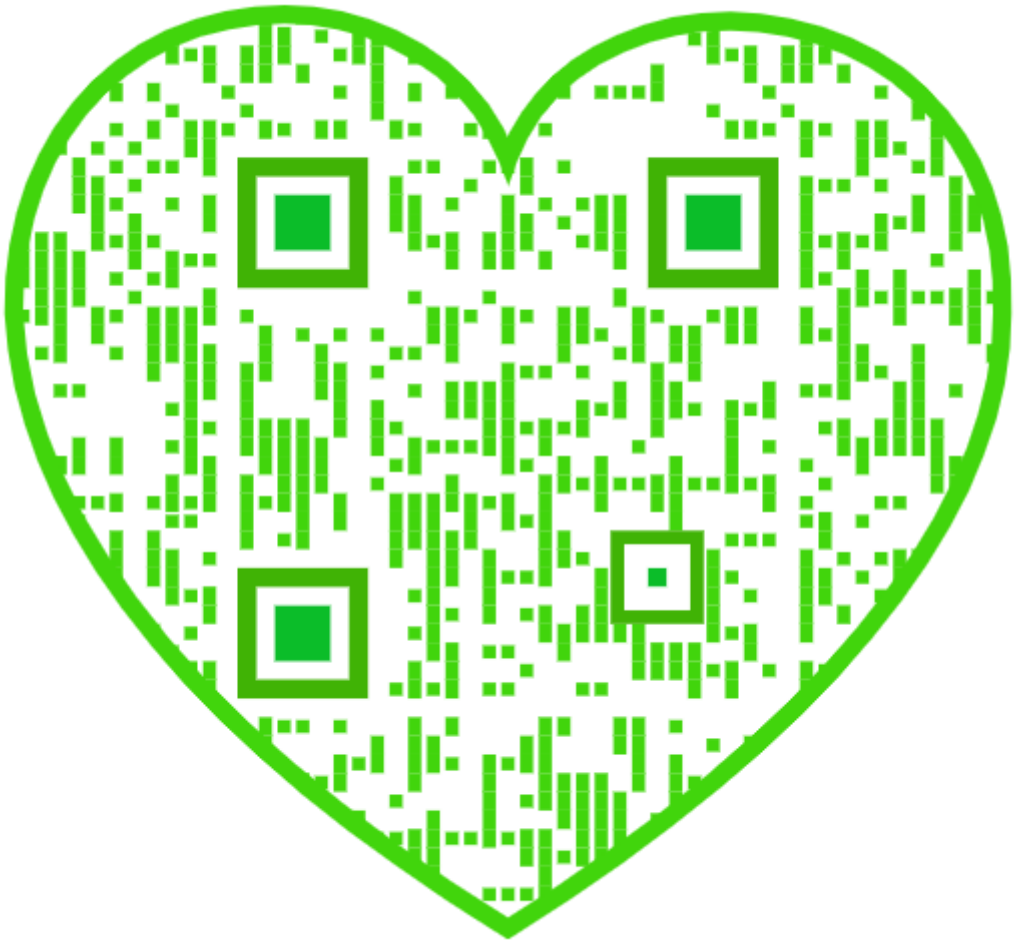

Yacht Squadron regatta, open to all nations, beating," after which follow the names of all the vessels which started in the race. On the next medallion is engraved, "Schooner America, 170 tons, Commodore John C. Stevens; built by George Steers, New York, 1851." On the other spaces are inscriptions recording the results of the races with the schooners Cambria, Livonia, and Countess of Dufferin, and the sloop Atalanta.

The programme for the races was as follows: Sept. 7, outside Sandy Hook, twenty miles to windward and return; Sept. 9, over the regular New York Club course, when, if a third race should become necessary to decide the contest, it was to be sailed over a forty mile triangular course outside Sandy Hook.

A Good Suggestion.

In giving estimates, says one of our contemporaries, do not make your calculations on loose scraps of paper and then throw them away, keeping only a memorandum of the amount. You may want to look over your figures some day, and verify the operations that gave them to you. Have a blankbook, and arrange an index for it; then make as many divisions or departments as the different classes of your work require, and be careful to observe the arrangement in your use of the book. Make all your calculations in this, compactly, make a note of number of the page in the index for easy reference, and the book will become more valuable to you every day.

The Longest Single Span Girder.

The new railroad bridge over the Ohio between Evansville, Ind., and Henderson, Ky., which was formally opened for traffic in the early part of August, enjoys the distinction of having the longest single span girder of any bridge yet constructed. It is built on the triangular truss plan, and is very symmetrical and pleasing in appearance. The structure has a length of 3,200 feet, and rests on sixteen piers, each span being 250 feet long, with the exception of the one over the main channel. This is 525 feet, and is, we believe, the longest single girder in the world. It is 103½ feet above low water, and 57 feet above high water mark. The bridge, with the lines connecting the railroad system centering at Evansville with the Louisville and Nashville system at Henderson, has a length of ten miles, three miles of the approach on the Indiana side being over a wooden trestle.

The bridge at Cincinnati, built several years ago, has a clear span of 515 feet, and was at the time of building the longest railway girder known. Next in length came the Kinlenburg Bridge in Holland, with a span of 492 feet. It is not probable that the Henderson Bridge will long enjoy its distinction, for the limits in this direction have already increased so surprisingly that spans of 800 feet, such as the central span of the contemplated bridge over the Hudson at Poughkeepsie, N. Y., are not considered impracticable; but 525 feet has not yet, we believe, been exceeded, except on paper.

The Effects of Lightning Stroke.

At a recent meeting of the Berlin "Verein fur Innere Medicin," Dr. Liman described the changes present in the bodies of two men who had been killed by lightning when taking shelter under the trees of the Thiergarten. In the one subject the hair over the left temple was singed, and the skin from the left ear to the shoulder-blade was discolored a brownish-red, the chest and abdomen being covered with red and white streaks. Reference was made to the dendritic figures described in many cases, and attributed often to impressions of twigs, leaves, etc., and in this body there was a figure which could be compared to a palm leaf, but which was undoubtedly due to the contact of the folds of the shirt. The parts thus pressed upon remained white, the surrounding skin being reddened. The apex of the heart was the seat of an irregular cavity, which communicated with both ventricles; evidently the lightning stroke had caused rupture of the organ. In the other case the skin and hair were similarly excoriated and singed, and numerous ecchymoses occurred beneath the serous layers of the pericardium and pleura; the lungs were much congested. Here death was evidently due to asphyxia. Dr. Liman mentioned, and Professor Leyden confirmed the fact, that death by lightning is occasionally accompanied by rupture of internal organs, as the brain and liver.

Decision in Regard to Patent Harrows.

Justice Stanley Matthews has decided in favor of the plaintiffs in the now celebrated case of D. C. and H. C. Reed and Co., patentees of the spring tooth harrow, *vs.* Chase, Taylor & Co. *et al.*, for infringement of patent, which was tried in the United States Court at Grand Rapids, Mich. The case has been before the courts for several years, and involved the past fifteen years' business in spring tooth flat harrows. By this decision the patentees will enjoy a royalty from every farmer or concern making any kind of infringement. It is one of the most important cases ever decided in patent litigation.

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NEW YORK, SATURDAY, SEPTEMBER 12, 1885.

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NEW YORK CABLE ROAD.

New York is now about to have its experience with a surface cable road, and having been a little behind other cities in this respect, it starts out with the advantage of their blunders as a warning.

The Third Avenue Railroad Company has completed its cable line on Tenth Avenue from 125th to 186th Street, and formally opened it to the public on the 29th of August. The constructing engineer, Mr. D. J. Miller, was an assistant on the Chicago Cable Railway, and his experience there suggested several novel features for the New York road. The objection that has always been urged against cable roads in general is on the ground that should any accident happen the cable, the entire road would be disabled. The fear of such an event has induced a feeling that the system is not altogether reliable.

More specific objections are due to the fact that often they work anything but satisfactorily, and are not always subject to that immediate control which should be an absolute requisite on any road passing through crowded thoroughfares. These, however, are objections which, though serious enough, as our experience in Philadelphia and Chicago has shown, are not essential to the system, and by a more perfect working out of the details are quite remediable.

The Tenth Avenue Road has therefore removed the essential fault of the system by providing for the contingency of a broken cable. Throughout its entire length, the road is constructed with a double cable. Both are contained in the same tube, so that in case of accident to one, it will be a matter of but a few minutes to put the other in operation, and so avoid any serious delays of travel. The road contains several heavy grades, and is a trifle over three miles in length. It is expected that the route will very shortly be extended across the city on 125th Street. The cable is of iron, 1¼ inches in diameter, and is 33,100 feet long, or about 6¼ miles. It weighed on the reel 46 tons.

The motive power plant is located at 128th Street and Tenth Avenue, where a handsome building of iron and moulded brick, 100 by 200 feet, has been erected, and furnishes ample and well arranged accommodation. The engines and cable gearing are placed in the basement. The two large engines, built by Mr. Wm. Wright, of Newburg, are each of 350 horse power, and are capable of operating both cables, so that ordinarily but one will be in use, and the reserved power will be an additional safeguard against delay or accident. These are supplemented by two donkey engines of 75 horse power each, which would be able to keep the cables moving, but at a reduced rate of speed. The entire building is lighted by an installation of Edison lamps. A No. 8 dynamo, of 3,200 candle power, and making 1,400 revolutions per minute, furnishes the necessary current. As such extravagant claims are put forward by various electric companies for their respective systems, the statement of the contractor may not be uninteresting, that the system introduced was giving 100 candle power for every horse power consumed. The lamps in use were 16 and 10 candle power, and 6¼ and 10 lamps respectively were therefore maintained by each horse power.

A considerable speed is claimed for the new road. The round trip of 6¼ miles, it is stated, can be made in 40 minutes. This, of course, is making no allowance for stoppages, but a moderate estimate for these delays would still leave a fair speed for surface travel.

SUBMARINE WARFARE.

The probability that the not distant future will see the perfection of the submarine torpedo boat and ram furnishes still another argument against the construction of great forts for harbor defense. If the marine monster now being completed at Fort Lafayette will do the half that is claimed for it, it would not be safe for the heaviest armed and armored ship afloat to lie at anchor or attempt to maneuver in its vicinity; for it must deal with an unseen enemy which guns cannot reach nor armed men overpower. Should this vessel prove a success, the art of defense may reasonably be looked upon as having outstripped the art of attack, and we can look back upon our dilatoriness in building harbor defenses with something like complaisance. Nor should it be forgotten, if this submarine vessel proves successful, that the success is in great part due to electricity and to the recent improvements in the storage battery and the electric light. The Holland submarine vessel proved that compressed air is both dangerous and uncertain when used under the conditions present in a submarine construction. It may be used as an auxiliary, but is not suitable for a main dependence. The secondary battery or the primary battery is, on the other hand, of certain action, and may therefore safely be depended upon to supply not only power, but also light. The testimony of divers proves that the electric light will illumine great distances under water. In a fog it shows itself lacking in the red and yellow tints which make gas and oil so effective, but beneath the surface of salt water, it seems, the powerful white and blue rays serve admirably to pierce the dim and somber-hued depths.

Few people are aware of how much power the se

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condary battery is capable of giving out under favorable conditions. When we set aside the question of cost—and such questions do not rise in the construction and operation of war material—sufficient power in the shape of electrical energy can readily be had to move a submarine vessel, and indeed to keep it moving for many hours. In such a vessel as that at Fort Lafayette, two complete and separate power batteries could be kept side by side in the hull, and when one is exhausted, the other could be turned on by simply moving a switch. So, too, with the lights; and when it is remembered that nine incandescence lights can be generated by expending one horse power per hour, it is readily seen that all the light required could be had for a mere song. The incandescence light, too, is particularly fitted for submarine work or navigation, because, since there is no combustion, no air is required. Being *in vacuo*, it does not in any way affect the air save to throw off a small modicum of heat, whereas the voltaic arc light requires a constant supply of air.

The plan of operating this unique vessel is to drop below the surface at long range after the compass course has been ascertained. The strength of the currents being known, the leeway is reckoned by dead reckoning, and the monster brought within range of the enemy's hull. Then comes the attack.

A HEAVY GUN THAT WILL NOT BURST.

Lying snugly housed near the point of Sandy Hook is a great gun, nearly thirty feet long. It has been there for some time, and is an object of curiosity to all who visit the neighborhood. This gun was designed in part by Mr. George Edgar, and is his property. Many thousands of dollars have been spent upon its construction and exhibition, but though a military committee reported favorably upon it, no steps were taken by the Government toward purchasing the patents taken out by its constructors. The claims made for the gun refer exclusively to the breech, which is said to possess no little novelty and merit.

Not long ago Mr. Edgar visited Washington on business connected with this gun. He was accompanied by an American mechanician and designer of guns, now employed by the Russian Government to conduct their great gun works on the Neva. After a somewhat unsatisfactory visit to the War Department, the two were sitting in the cafe of the Ebbitt House, discussing the chances of the adoption of the principle of the big gun by the military authorities.

"They tell me," said Mr. Edgar, "that what they want is a gun that won't explode; when they get such a one, they say they expect to have no trouble in finding an easy working and efficient breech mechanism."

"Yes," replied his companion, "that's what they are looking for all over the world."

The two men sat silent for some time.

Finally, Mr. Edgar, in crossing his legs, kicked off the cover from an India rubber cuspidor. Like most of these contrivances, this cover was made of hard rubber with beveled edges, the sides as they sloped toward the hole in the center having a fall or decline of about 30° from a plane.

Mr. Edgar observed this cover intently as it rolled and gyrated about the marble floor.

Before it came to a dead stop he seized it with something like precipitation, and with sparkling eyes exclaimed to his companion, "I've got it!"

"Got what?" asked the latter languidly.

"I've got the principle on which the non-bursting gun can be constructed."

"Bah!"

Not heeding this expression of incredulity on the part of his friend, a man, too, of great skill in metal working, Mr. Edgar gave such forcible reasons for believing a non-bursting gun could be constructed of a series of plates similar in form to the top of a rubber cuspidor, that he was compelled to admit that there was something in the idea.

Returning to New York city, Mr. Edgar at once set to work to make a gun on the plan suggested by the incident in the Ebbitt House cafe.

This experimental gun is four feet long, and composed throughout its whole extent of corrugated plates of Russian iron. At its completion, he took it up to West Point, which, he had been told in Washington, was one of the Government testing points for guns.

On his arrival at the works, and mentioning the fact that he had a new gun with him, he was told that the number of new guns constantly appearing was legion. "The trouble with all of them," said the officer, "is that they burst too readily. What kind of a test do you want us to put your gun to?" he added.

"Why," replied Mr. Edgar, "I would like to have you burst it."

"Certainly," said the officer, with something like sarcasm in his voice. "We're always glad to accommodate gentlemen with new guns."

The gun was now taken behind a hill, a double charge of powder introduced, and fired with a time fuse. It turned two or three back somersaults, but remained intact. It was now loaded with a quadruple charge, and fired, the only effect being to multiply the number of the back somersaults.

"This is very good indeed," said the officer. "I'm sorry to keep you waiting so long. I'll now load it up to the muzzle, and that will be the last of it." Fired under these conditions, it rose in the air, whirled around for a few moments, and then came down and buried itself in the earth. After being dug up it was charged nearly up to the muzzle with powder and wad, and then spiked. The only result was that it rose higher in the air than before, spun around more rapidly, and buried itself still deeper in the ground when it came down. It had not even been chipped!

"Is there anything else you'd like to put into it?" demanded Mr. Edgar, it being now his turn to be ironical.

"No!" was the reply; "it beats me." Having thus stumped the gun testing authorities, Mr. Edgar brought his little gun back to New York in triumph.

THE DECLINE OF THE SAILOR.

It is not so long ago that the test of a sailor's qualifications as a man-of-war's man was the expertness with which he could hand, reef, and steer. He was given a trial aloft and alow, and then rated as a first-class seaman, ordinary seaman, or landsman and lubber. All this is being rapidly changed by the appearance on the ocean of complicated collections of machinery protected with heavy armor and called modern warships. When they engage the enemy, it is an artillery duel or pounding match at long range, and the lusty calls to prepare to receive boarders or for the pikemen to advance are never heard. The trumpet no longer calls aloft to the nimble topmen, for scarce a sail remains. There is no running in and out of guns. When they are moved or loaded, it is by machinery. This is indeed a sad day for Jack. The man who coils rope against the sun, and regards the bowsprit as a prolongation of the keelson, is on the same plane with him. The captains of the tops now stand their watches in the machine shop or stoke hole, and the ship's yeoman is set to stir the duff pudding. It is bad enough to have to navigate the seas in a teapot, as Jack calls the steamer, but now there is a tendency to build submarine warships, and this will drain Jack's cup of sorrows to the lees.

In the old days naval officers were expert navigators and nothing more, and their crews were sailors. Today the officers must be scientists and the men mechanics.

ASTRONOMICAL NOTES.

THE COMET OF 1858,

or Tuttle's comet, which has been expected for a year, was first seen at Nice, France, on the 10th of August. The news was quickly sent by cable message from Kiel, Prussia, to Harvard College Observatory, and as quickly reported by telegraph through the United States. This comet was first discovered by Mechain at Paris, on the 28th of January, 1790. Its periodicity, however, was not established until after its second discovery by Tuttle of the Harvard College Observatory, on the 4th of January, 1858. The period was determined to be 13·78 years, and it passed its perihelion on the 23d of February, 1858. It made its first recorded return on time, being first seen at that return by Borelly at Marseilles, on the 12th of October, 1871, passing its perihelion on the 2d of December of the same year. The reappearance of this comet at the present time was confidently expected, and observers were instructed to make a close examination of the northeastern heavens during the absence of the moon in August just before morning twilight.

The search was successful, and the erratic visitor was picked up safe and sound, after its long journey of nearly fourteen years. It will reach perihelion about the 11th of September, and will therefore rank as the third comet, or comet *c* of 1885. Encke's comet, having passed its perihelion in March, stands on the records as comet *a*, and Barnard's comet takes its place as comet *b*. The comet's place when found was in Gemini, and it rose about 2 o'clock in the morning. Its distance from the earth was 1·91 in terms of the earth's mean distance from the sun. The distance is diminishing and the brightness should be increasing, but is not up to the standard of its first aspect when seen in 1871.

BARNARD'S COMET,

or comet *a*, has been extensively observed in Europe. It was seen at Kiel on the 10th of July; at Arcetri (Florence), Vienna, and Strasbourg on the 11th of July; and at Rome and Palermo on the 12th of July. It is receding from the earth, and becoming gradually fainter. Its perihelion passage takes place on the 25th of September, when the comet's distance from the sun will be 2·295 in terms of the earth's mean distance. The comet seems to possess little to commend it to notice, its only claim being that thus far it is the only cometic prize of the year. The other two comets are old friends, returning to make their periodical visits.

ASTEROIDS.

Professor Peters, of Clinton, has added to the laurels he has already won in the same department of investigation, by discovering on the 16th of August an asteroid of the 12th magnitude, which takes rank as No. 249. The newcomer has not yet been honored with a name.

Dr. Palisa, of Vienna, has increased his voluminous record in the same department by the discovery of asteroid No. 248, and named it Lameia. The two latest comers of this rapidly increasing family were preceded since the year commenced by the advent of three others, five asteroids having thus far been picked up in 1885. The year is neither fertile in asteroids nor comets, but none may foretell what wonders the remaining three months of the year may produce.

PHOTOGRAPHS OF THE ORION NEBULA.

The late Professor Henry Draper was the first to succeed in obtaining a successful photograph of the famous nebula in Orion. Mr. Common, an English astronomer, is interested in the same field of work. He exhibited, at a recent meeting of the British Astronomical Society, a series of enlargements of photographs of the Orion nebula, taken with different exposures varying from a few minutes up to sixty minutes. With the longer exposures, the outer and fainter portions of the nebula were shown, but the inner and brighter portions were obscured by over-exposure. It was only by a combination of such pictures that the whole of the details visible in the nebula could be studied. With the longer exposures, regions of the nebula invisible to the eye with the telescope register themselves on the photographic plate. Mr. Common had obtained, with an exposure of sixty minutes, traces of many stars invisible to the eye. He had not at present tested what could be obtained by still longer exposure. Reliable photographs of the present condition of this wonder of the skies will be an inestimable gift to the astronomers of the future.

Meeting of the American Association.

This year's meeting of the American Association for the Advancement of Science was opened at Ann Arbor, Michigan, August 27. In section A, papers were heard on subjects relating to the sun and planets and astronomical instruments. In section B, Professor S. P. Langley, of Allegheny, opened with a paper on "The Spectra of Some Sources of Invisible Heat," describing experiments with a spectroscope which had been engaging his attention for the past two years, which had led him to believe that the wave length is greater than heretofore believed. Other papers were read on different phases of optics, E. S. Nichols closing the first day with a paper on "The Chemical Behavior of Iron in the Magnetic Field."

In section C, papers on "Butter Crystallization," "Colorimetric Method for Estimation of Phosphorus in Iron and Steel," and a few other technical papers were read. C. F. Mabery, of Cleveland, had a paper on "The Electrical Furnace and the Reduction of the Oxides of Boron, Silicon, Aluminum, and other Metals by Carbon."

In section D, "Strength of Staybolts in Boilers," "Universal Form of Pressure Motor," and "Use and Value of Accurate Standards for Surveyors' Chains," were the first papers considered by the section on mechanical science, and a committee reported as to the best methods of teaching mechanical engineering.

In section E, Professor Alexander Winchell described the geology of Ann Arbor, and the second paper was on "The Lower Helderberg Period in New York." L. E. Hicks, of Lincoln, Nebraska, had a paper on "The Structure and Relations of the Dakota Group," in which he gave an arithmetical statement of the strata and their composition in that region. A. H. Worthen, of Springfield, Ill., read a paper on the structure of the quaternary deposits of Illinois, and G. H. Gilbert, of Washington, followed with a discussion of "Post-Glacial Changes of Level in the Basin of Lake Ontario as observed in the Old Beach Outline of that Lake." Professor Alexander Winchell, of Michigan University, discussed sources of trend and crustal surpulsages in mountain structure.

In section F, papers were read on "Cross Fertilization," "Germination," "Influence of Cocaine and Atropine on the Organs of Circulation." Professor C. V. Riley had papers on the "Song Notes of the Periodical Locusts, and how they are produced" and "Some Popular Fallacies and New Facts Regarding the Seventeen Year Locusts." J. C. Arthur, of Geneva, N. Y., advanced proof that bacteria are the direct cause of the disease in trees known as "pear blight." The "Mechanical Injury of Trees by Cold" was treated by J. J. Burrill, of Champaign, Ill.

A Simple Method of Fixing Crayon Drawings on Paper.

Prof. F. P. Dunnington, University of Virginia, says: It is frequently desirable to preserve drawings made on the blackboard for purposes of class illustration. All such drawings may be readily made with colored crayons upon unsized paper, and then fixed by passing the paper through a bath of dilute varnish, consisting of one part dammar varnish and twenty-five parts of spirits of turpentine. The paper is then allowed to dry over night, and may be handled and rubbed without blurring the drawing.

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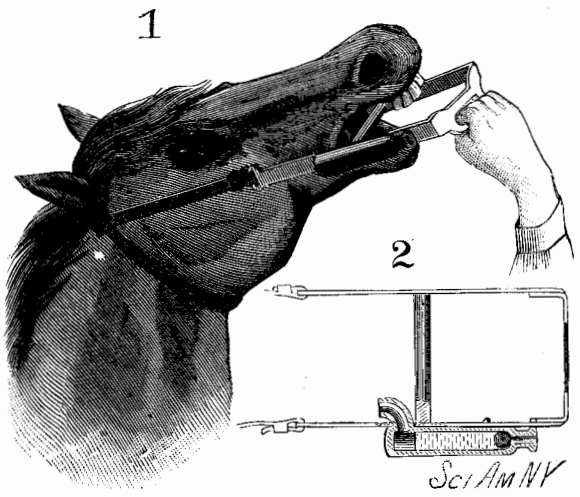
DRENCHING BIT.

The object of the invention herewith illustrated, lately patented by Mr. James F. Marvin, of Fort Apache, Arizona, is to provide a simple and effective device for administering medicine to horses. The bit is formed of two similar side pieces having loops at their upper ends for receiving the ordinary bridle straps, and connected at their lower ends by a cross-piece formed with a handle. Near the middle the side pieces are united by a transverse bar. To one side piece is secured a cylindrical reservoir closed at the top and opened at the bottom, the open end being closed



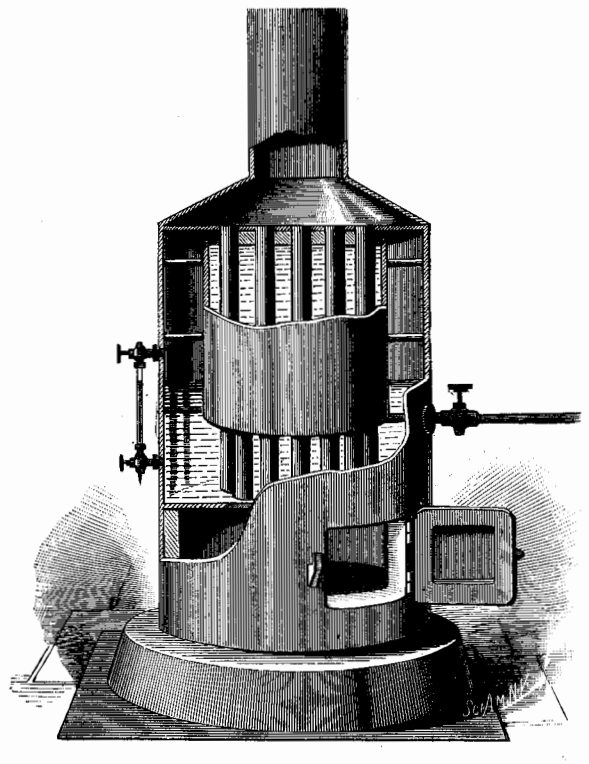
MARVIN'S DRENCHING BIT.

by a ball valve. Projecting from the side of the upper end of the reservoir is a curved spout, shown in Fig. 2. When the bit is in position in the horse's mouth, the middle bar occupies the same position as the ordinary bit bar, and the spout enters the mouth and opens toward the throat. The reservoir is filled through the spout. The horse's head is raised by grasping the handle and pushing up on the bit. The contents then flow out of the spout into the horse's mouth, while air is admitted to the reservoir through its open end, the valve having fallen away from its seat.

UPRIGHT STEAM BOILER.

The accompanying engraving shows an upright steam boiler provided with a suspended reservoir within the boiler, which is kept constantly filled with water by an injector. The boiler is provided with the usual fireplace, and with flues between the top and bottom plates to connect the fireplace with the dome. The reservoir is held between the top and bottom plates by stays, and is open at the top, which reaches near to the top plate, and the bottom is immersed in the water; all the flues pass through the reservoir. An injector passes through the shell of the boiler, and opens into the reservoir near its bottom.

The injector fills the reservoir, and the latter being open at the top allows the water to overflow and fill



THODE'S UPRIGHT STEAM BOILER.

the boiler to the water level, which is indicated by the water gauge. It will be observed that the lower parts of the flues are surrounded by water in the boiler between the bottom plate and bottom of the reservoir, and the upper parts of the flues are surrounded by water in the reservoir up to the top plate. The water in the boiler is converted into steam in the usual way from the fireplace by means of the bottom plate and lower parts of the flues, and the water in the reservoir is converted into steam by the upper parts of the flues, this being the additional heating surface gained by this improvement. The quantity of water converted into steam is equalized by the injector, by removing which the reservoir can be cleaned.

This invention has been patented by Mr. G. A. Thode, of Holstein, Iowa.

AN IMPROVED TUNNEL STRAINER.

The annexed drawing illustrates a new, cheap, and serviceable article, the subject of a patent recently granted to Mr. Francis O. Butterfield, No. 6 Vine St., Lynn, Mass. It is adapted to household use, for apothecaries for straining liquids, and can also be used in the sink spout, if made of heavy material, to prevent substances other than liquid passing down the spout.

The illustration represents the tunnel strainer placed in the tube of a tunnel. The strainer is by preference made of wire cloth, or other material if desired, rolled into tapering tubular form, so as to fit tubes of any ordinary tunnels. The larger end of the strainer is closed by a metal cap, provided with a ring for convenience in use, also to hang the same up with when not in use. The lower end of the strainer is open, and provided with a metal thimble to shield the wire cloth; and it fits snugly in the tube of the tunnel, so that no liquid can pass through the tunnel tube without first passing through the wire-cloth strainer. For ordinary use it will be about 4 or 5 inches long, about 3 or 4 inches circumference at its larger end, and taper downward gradually to a very small circumference; it being so comparatively small, and the tapering of the strainer being so much less than that of the tunnel, and the strainer taking up so little space in the tunnel that ample space is left between the strainer and tunnel to receive the liquid.

American Expositions.

There is to be a flood of American expositions on the other side of the water next year.

Besides the permanent display of American manufactures and products to be opened in London, another of the same kind, or rather series of them, are to be inaugurated in Rome and the other principal cities of Italy. These are to be conducted under the auspices of the Minister of Agriculture, Industry, and Commerce, the purpose being to give the Italians some idea of American products, so as to develop a trade between this continent and Italy. American manufacturers are also invited by Germany and by other European powers to make displays in their permanent trade exhibitions.

The general interest in this continent thus shown by the European powers does not need much explanation. There is a great desire on their part just now to arrange closer relations with America, not with the United States alone, but with Mexico and Central and South America as well. They recognize the fact that the trade of these two continents is immensely large and profitable, and growing faster than that of any portion of the world. When one or two problems are solved, such as a transit route over the Isthmus and the pacification and development of Central and South America, as Mexico has been pacified and developed, this growth will be far more rapid than it is to-day. The foreign trade of America constitutes about one-fourth of the total trade of the world to-day; it was only one-eighth thirty years ago; it will be one-half in another thirty years.

Europe appreciates this, and is holding out all manner of inducements to the countries of America. England, Italy, and Germany all want American exhibitions, and want to attract American trade. We hold before all these others an American exposition in this city which is devoted somewhat to these same purposes—to securing for the United States the trade of Latin America, to keeping it at home instead of letting it fall into the hands of Europe. It is evident, in these expositions and from many other facts, that there is to be a warm commercial fight for the trade of the Americans. The United States is the first in the field; and if it utilizes the North, Central, and South American Exposition to good advantage, by showing our products and manufactures to all the countries south of us, and by learning something of their resources, we will secure an advantage which cannot be offset by these other expositions. It is a grand field to fight for, and on our victory here depends much of the future prosperity of the country. It is to be hoped that the people of the United States recognize this, and appreciate the very able arguments used by the management of the new exposition, showing how necessary it is to secure the trade, and how much can be done through the coming exposition.—*New Orleans Times-Democrat.*

Mosquito Oil.

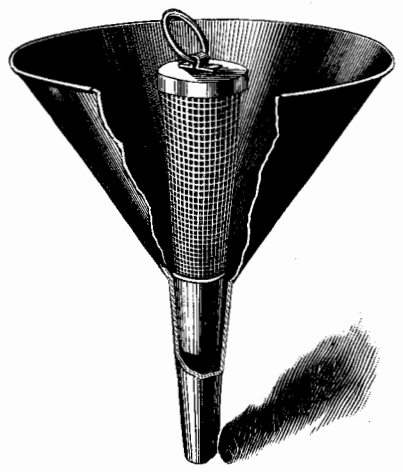
THE *Angler* vouches for the effectiveness of the following mixture for keeping off mosquitoes:

Olive oil	3 parts.
Oil of pennyroyal	2 "
Glycerine	1 "
Ammonia	1 "

To be well shaken before applying to the face and hands. Avoid getting the mixture into the eyes.

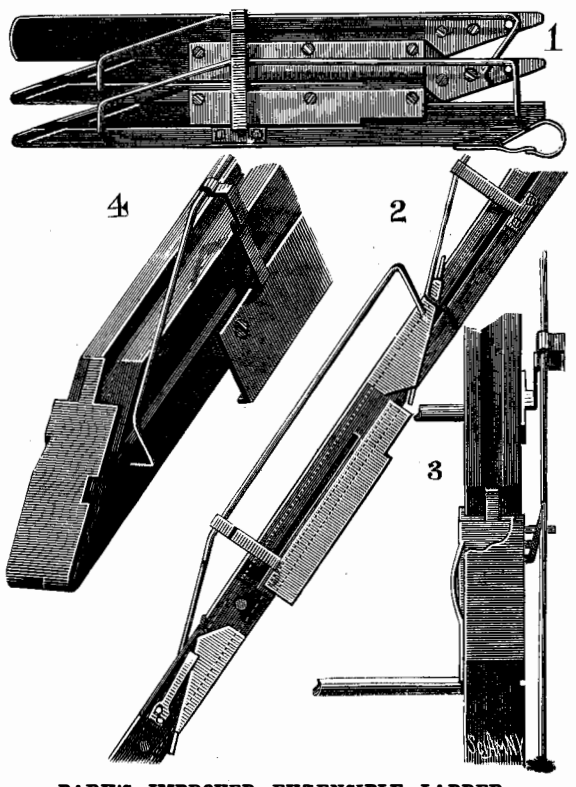
IMPROVED EXTENSIBLE LADDER.

The object of this invention is to facilitate the extension and contraction of the ladder, and provide for automatic and secure locking of the sections in line when extended, and also to promote safety in the use of the ladder as a fire escape, for which service it is especially designed. Fig. 1 is a side view of a three section ladder contracted; Fig. 2 is a side view of the ladder extended for use; Fig. 3 is a front elevation of one of the side bars showing the couplings; and Fig. 4 is an inside perspective view of the lower end of one of the ladder bars. The end of the upper section is pro-



BUTTERFIELD'S IMPROVED TUNNEL STRAINER.

vided with hooks, by means of which the ladder when used as a fire escape may be securely held to a crossbar of a window or the rail of a balcony. The ladder sections are alike, except that the upper one is not furnished with guide plates on its side bars, as are the others, and the lower section has no hand rails and has its lower ends pointed to rest on the ground. The meeting ends of the sections are so beveled as to lie fairly upon each other when the ladder is extended. The metal coupling plates are [-shaped in cross section, and fit the beveled ends of the side bars of the sections, as shown in Fig. 4. Between the beveled portion of the bar and the upper part of the plate is a space sufficient to permit the parts of the plates to slide by each other to lock the ladder extended. The end of that part of the plate over the bevel is formed with a projecting lip that enters an opening in the end bends of the plate, thereby making additional interlocking connections to prevent lateral play of the sections on each other. When the sections are extended, spring catches on the side bars of one section lock into notches on the ends of the other, to hold the sections firmly in line with each other. To each side bar of the ladder section is a guide bar so arranged as to guide the upper ladder section down to and in line with the next lower section, so that the coupling plates will engage with each other; these bars also serve as hand rails for persons



PARK'S IMPROVED EXTENSIBLE LADDER.

going up or down. To the opposite side bars of the two lower sections are fastened metal guide plates having inturned flanges at their lower edges, which enter grooves in the outer faces of the side bars of the two upper sections when the ladder is contracted.

It is evident that this ladder, the invention of Mr. Thomas R. Park, of Parkersburg, W. Va., can be very quickly extended for use as a fire escape, and that it can be used for any ordinary service required of a ladder; it will stand firmly, so as to carry as heavy a weight as one having side bars made in one piece.

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INDEPENDENT AIR AND CIRCULATING PUMPING ENGINE FOR THE UNITED STATES CRUISER CHICAGO.

The practice of using independent air and circulating pumps for marine engines was inaugurated some years ago to a limited extent in the merchant marine, but it was never carried into use in large sea-going vessels until the Naval Advisory Board took up the subject for consideration, and finally adopted this system for the new cruisers and naval dispatch boat which are being completed.

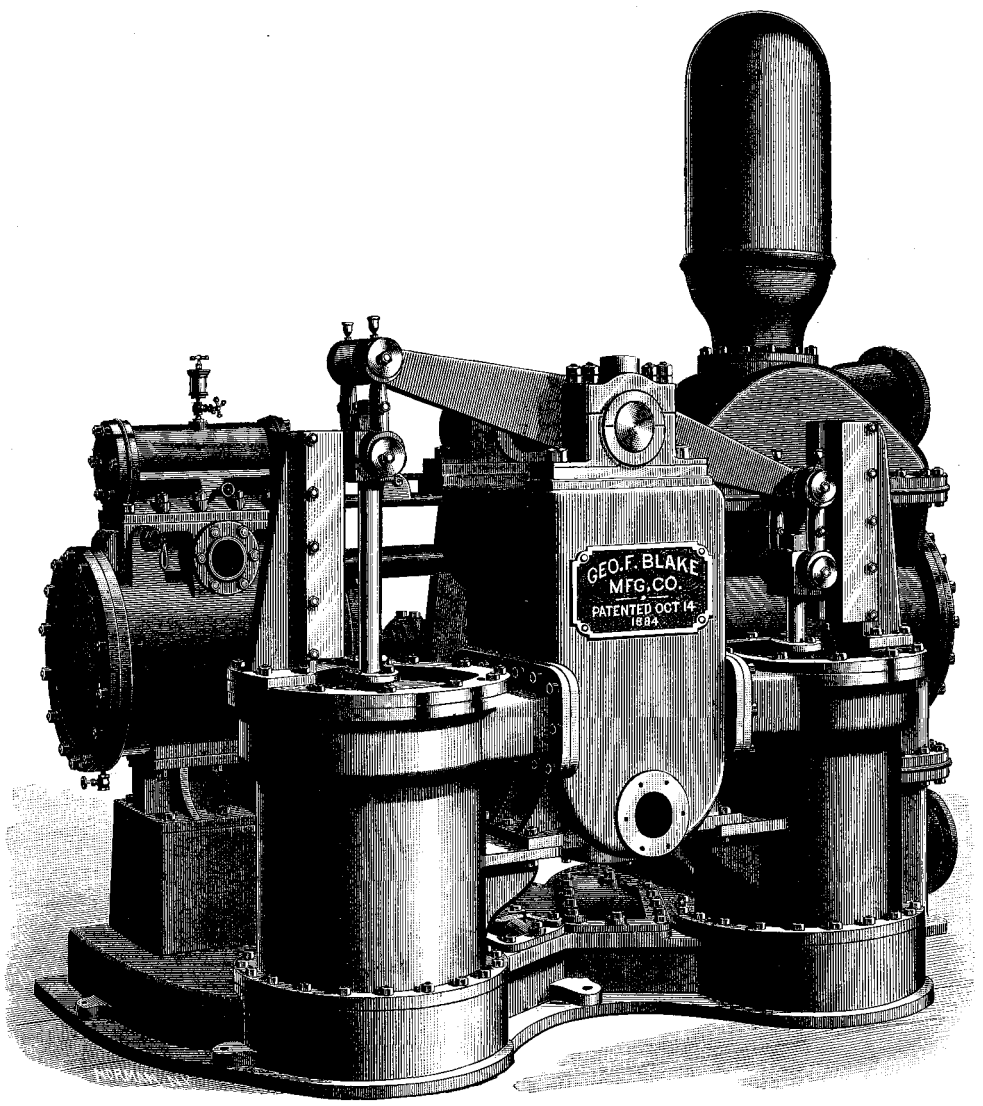
This system of divesting the engine of all pumps of every character is a great stride in economy and simplicity, as will be shown by a rehearsal of the advantages as below. It has been the common practice for many years to make the circulating pump an independent machine, either a direct acting or a centrifugal pump. Bilge pumps and feed pumps were also detached from the engines and made independent, and finally nothing was left but the air pump connected to the engine. It has now been found that to work the air pump independently is even of greater advantage. Briefly stated, the advantages gained by the use of independent air and circulating pumps are as follows: They work much more economically than connected pumps. The pump speed can be accurately regulated, according to the requirements of the main engines and the temperature of the circulating water, which latter, of course, varies with the season and climate. Pumps always work more efficiently at relatively low piston speeds; consequently, a slower speeded independent pump is much more efficient than one connected to the main engine, running at a higher rate of speed; in other words, there is much less loss by "slippage," the pumps performing nearer to their theoretical capacity. Combining the air and circulating pumps is an advantage, for the latter serves as a regulator to the former, inasmuch as it produces a steadier action, as the load on the air pump varies with the travel of the piston during its stroke. The vacuum can be maintained in the condenser while the main engines are stopped, simply by keeping the pumps traveling slowly. This is a matter of considerable importance, especially in war vessels when maneuvering, and in merchant steamers where they are continually stopping and starting during foggy weather. The vacuum being always kept up, the engine can be promptly started, and there is no danger of getting the condenser hot while the main engines are stopped. This is an incalculable advantage in ferry boats, as has been proved by the late tests on the Pennsylvania Railroad Company's boat Baltimore, a trial trip of which was reported in our columns a few weeks since. The air and circulating pumps can be used as wrecking or bilge pumps, and as their capacities are so vastly in excess of the ordinary pumps of the vessel, they become very important adjuncts to a vessel's safety. Many an engine has been broken down at sea from the air pumps not being able to withstand the racing of the engine.

The illustrations here given represent the arrangement of independent air and circulating pumps, as constructed by the Geo. F. Blake Manufacturing Company for the engines of the U. S. cruiser Chicago, a twin screw vessel of 5,000 indicated horse power.* There are two of these independent air and circulating pumping engines, one for each of the engines of the vessel.

As will be readily understood by reference to the accompanying engraving, the combination is that of a double-acting horizontal circulating piston pump with two single-acting vertical air pumps. The circulating pump piston is connected directly to the piston of the steam cylinder; the buckets of the air pumps are operated from each end of a working beam, which receives its motion from a lever arm connected by a short link to the crosshead of the piston rod. The dimensions of each of these pumping engines are as follows: Steam cylinder, 20 inches diameter by 24 inches stroke; air pumps, each, 24½ inches diameter by 21 inches stroke; circulating pump, 26 inches diameter by 24 inches stroke; the capacity of circulating pump per minute, 55 gallons; diameter of injection pipe, 15 inches; diameter of discharge pipe, 14 inches; single strokes per minute, 40 to 60. It might be well to state that the dimensions of the cylinders of each of the engines of the Chicago are as follows: High pressure steam cylinder, 45 inches diameter by 52 inches stroke; low pressure steam cylinder, 78 inches diameter by 54 inches stroke. The engine will run 75 revolutions per minute, and show 2,500 indicated horse power.

The air and circulating pumps of the Dolphin are practically duplicates of those for the Chicago.

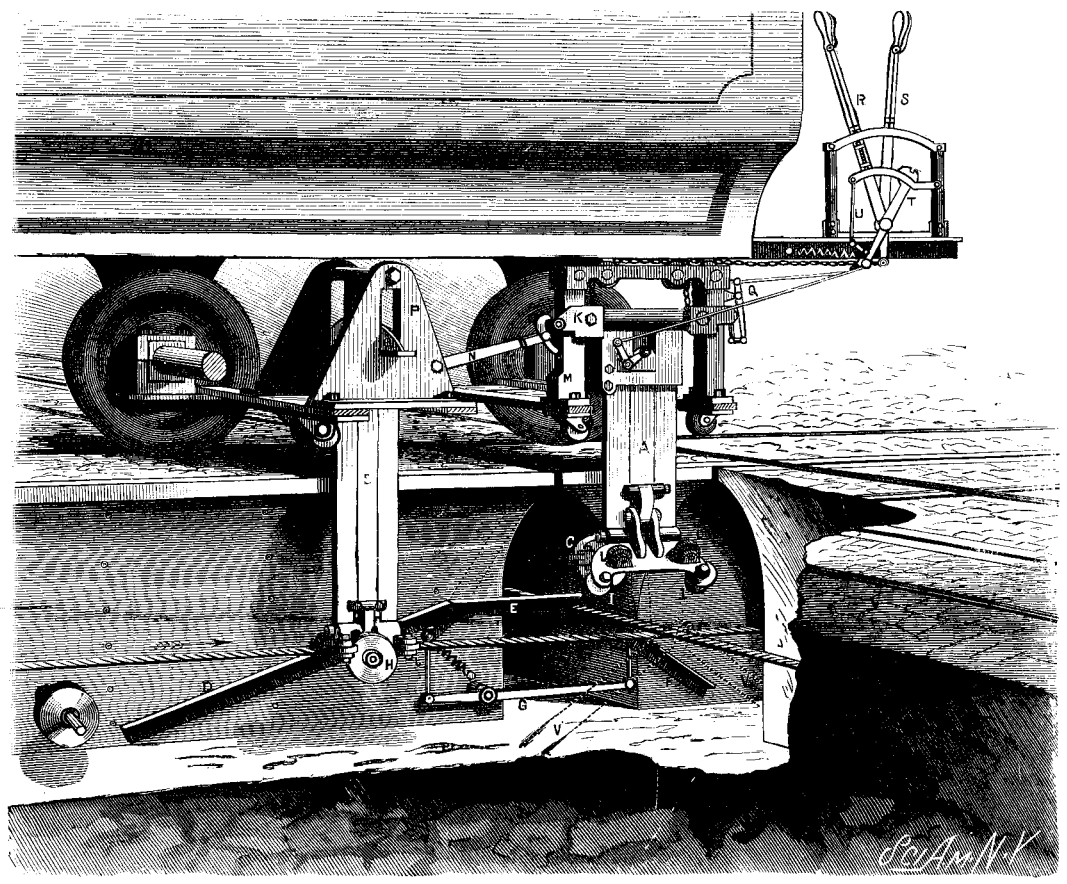
* For description of this cruiser and Dolphin, see SCIENTIFIC AMERICAN of December 22, 1883.



PUMPING ENGINES FOR U. S. CRUISER CHICAGO.

NEW METHOD OF GRIPPING AND CROSSING CABLES.

The accompanying illustration represents a mechanism consisting of two grips, the first of which seizes the cable to propel the car ordinarily, while the second seizes the cable during the passage of the first one over a crossing cable. As the forward grip approaches another cable, which may cross the first one at any angle, the carrying pulleys run up an inclined plane, automatically close the back grip upon the cable, and release the forward one; the car is then propelled by the back grip. As soon as the front grip has passed the crossing cable, it falls in position over its own cable, which it is made to seize by a lever, when it again propels the car. The back grip, passing up the inclined plane, frees itself from the cable, and, passing over the crossing cable, drops in position with its jaws open over its own cable ready to be called into action at the next crossing. With this grip it is easy to switch from the cable of one road and go upon the cable of another running at right angles or at any other angle to the first. The action is positive all the time, thereby rendering unnecessary the dependence upon momentum to carry the cars anywhere when the grip is loosened from the cable; curves are rounded easily and without trouble.



RAMSDEN'S METHOD OF GRIPPING AND CROSSING CABLES.

The frame supporting the parts consists of bars extending beneath the car from axle to axle, and united by cross bars. Firmly secured to two of the cross bars are two vertical hollow slide posts, M, connected at the top by a cross girt, in each end of which are two pulleys. Under the posts are pulleys placed in line with the outside ones on the cross girt. A cross head, K, formed with rectangular slotted ends, slides vertically between the posts. Chains pass from each end of the cross head around the lower pulleys, through the posts and over the upper pulleys, to adjustable eye bolts, thus forming a parallel motion for the cross head, which is reciprocated by operating the lever, S, to the lower end of which it is connected by a chain. A link is fitted at its top end to oscillate freely on the central cylindrical part of the cross head.

The lower end of the link receives the ends of a forked plate, of proper thickness to pass freely through the slot of the conduit; the joint is so formed as to permit the plate to oscillate in the link, thereby allowing of side motion of the car while rounding curves, etc., without its materially affecting the passage of the plate through the conduit slot. The closed end of the plate is curved backward and dovetailed across its face, to receive a friction block; below the dovetail it is bent still further back to serve to guide the cable to its grip when the latter falls to the normal level of the cable. On one side of the plate is a roller, C, for carrying the grip up the inclined plane, D, in the conduit. On each side of the lower part of the grip are horizontally placed rollers so disposed as to be opposite the strain of the motor when rounding curves to the right or left. At each end is a carrier pulley for carrying the cable while the car is stopped.

A short plate of sufficient thickness is dovetailed to correspond with the dovetail of the vertical plate, to which it is hinged by a bolt; the short plate fits snugly between lugs on the other, and projects above and outward from them. The end of the projection is forked to admit one end of a link, whose other end is joined to a plate, A, sliding freely between the forks of the vertical plate. The upper end of the sliding plate, A, is connected with bell cranks having their fulcrum pin in the top of the vertical plate. The opposite end of the bell cranks is attached to a rod leading to the lower end of the lever, R, by means of which the short plate or movable jaw can be operated,

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The cross head, K, supports all the parts of the main grip.

To the two rear cross bars of the frame are secured triangular plates, P, slotted to receive a cross head which supports all the working parts of the auxiliary grip. The triangular plates are set wide enough apart to allow for the side motion of the car when passing curves or irregularities of the track, without impeding the passage of the grip through the slot. That portion of the auxiliary grip operating in the conduit is the same as the corresponding portion of the main grip. In the upper end of the sliding plate, B, is a spring inclosing a guide bolt attached to a block sliding vertically in the plate. To the sliding block is connected the lever, N, having at its other end a pawl, L, acted upon by a pin in the cross head, K, of the main grip.

The operation of the device will be easily understood. By operating the lever, R, the movable jaw of the main grip is closed, and the carrier pulleys are passed under to secure the position of the cable between the jaws. Then, by operating the lever, S, the main grip is raised high enough to clear the pulleys in the conduit. Simultaneously the cable is raised into the jaws of the auxiliary grip, and they are closed so as to barely grasp the cable by the connection of the lever, N, with the cross head of the main grip.

By further operating the lever, R, the jaws of the main grip are closed until the cable is firmly held. Thus by manipulating the lever, R, the cable can be sufficiently released, without its being dropped, to allow of stopping the car. Also the cable can be entirely released from both grips, and by means of the lever, S, can be instantly picked up. On arriving at the flange, D, the roller, C, of the main grip passes up, and raises the main grip and cable. When it has lifted a short distance, the pin on the end of the cross head, K, acts on the pawl, L, of the lever, N, thereby closing the jaws of the auxiliary grip firmly on the cable. At the same time a projection on the opposite end of the cross head operates the lever, Q, which, through suitable connections, releases a catch on the lever, R, which is then moved by a spring, and the jaws of the main grip are opened to drop the cable.

As the roller, C, passes on, the flanges, E and F, are closed to form a path over the crossing cable. As the cross head, K, descends, it acts on the pawl to open the jaws of the auxiliary grip; the cable is then grasped by the main grip as before. It will be seen that the car is propelled over the crossing cable by the positive action of its own cable, and under any conditions the grips are not liable to come in contact with the crossing cable. The claims of this grip have been most satisfactorily demonstrated by a model one-fourth working size.

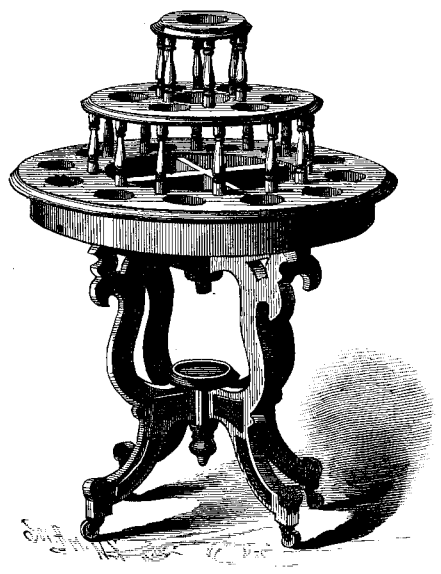
Further particulars regarding this invention can be obtained from E. C. Hine, M.D., 1834 Green Street, Philadelphia, Pa.

Hatched by a Cat.

A remarkable cat lives at No. 93 Fifteenth Street, South Brooklyn. From an early age she has displayed a great fondness for hatching out chickens. She sits on eggs like an old hen, until the feathered young break the shell, and then she cares for them as affectionately as if they were orthodox kittens. Four families of chickens have been hatched by this cat, and she is now busily engaged on the fifth, with a very fair prospect of success. The animal is the property of Mrs. Leonard, an intelligent Irishwoman, who resides with her husband in a cottage at the above address. A *Herald* reporter called at the house yesterday afternoon to see the wonder. In one corner of the kitchen, partitioned off from the rest of the room, was a large birdcage, around which a dozen chickens were strutting and picking up a meal. Inside the cage, on a bed of straw, was a cat of unprepossessing appearance, but of stalwart proportions, covering four eggs. The latter were disclosed to view as the reporter approached the cage, and the animal left her nest to play with a chicken. Then she returned to her task, extending her body at full length over the eggs and completely hiding them. The chickens she had already brought into the world seemed to possess as much filial affection as is generally shown by little chicks for their natural mothers, and they pirouetted about the cat in the most familiar way, climbing on her back, enjoying her warm coat of fur, until a movement of her body tumbled them off. After she had become weary of sitting, the cat made a tour among her young, and carried them to different parts of the inclosure. Her method of transportation was by the neck, and the chickens did not seem to mind this kind of transit any more than if they were kittens. She has been very kind to them, and has never made a meal of her offspring. It is related that when her first chicks appeared, she carried one of them by the neck up the cellar stairs. The flesh of the young biped being very tender, and the journey somewhat long, blood soon flowed. Instead of devouring the chick after she had tasted its blood, she applied her tongue daily to the neck until the wound healed. The cat came to Mrs. Leonard's house about a year ago, unheralded and unknown, and the next day was found on a nest of eggs, deserted by a hen who should have been sitting. She was driven off repeatedly, for fear she would break the eggs; but, persisting in her purpose, brought forth a brood of chickens that astonished the household. About a score of chickens have been brought into the world through her agency.—*N. Y. Herald.*

FLOWER STAND.

The top of the standard is so shaped as to receive a metal funnel, from which a tube projects downward to the top of a recess formed in the standard and adapted to receive a vessel, the neck of which fits on the lower end of the conducting tube. Cross pieces secured on top of the standard extend over the funnel, and from their intersections a pivot projects upward and through the intersections of cross pieces on a hollow circular top formed with an annular track resting on rollers pivoted in the top of the standard. On the projecting ends of the cross pieces is secured an annular trough provided with gutters leading into the upper part of the funnel. The revolving top has three



BURCH'S FLOWER STAND.

or more risers formed with holes for receiving the flower pots, which rest upon plates secured to the under side of the steps. The drip water from the pots on the two inner steps drops directly into the funnel, and the water from the pots on the outer step is led by the gutters to the funnel. The vessel to receive the drip water is not shown in the engraving.

This flower stand, the invention of Mrs. Nancy E. Burch, of Carthage, Mo., may be made very attractive in appearance; the flowers in the pots can be watered without soiling or wetting the floor, and the top can be easily turned so that each pot can be reached.

Infectious and Parasitic Pneumonia.

Mr. Germain See (*Comptes Rendus*, xix., pp. 931–3) finds that pneumonia may be epidemic, and has endeavored to see whether such attacks are distinct from ordinary pneumonia; such a view is demonstrated to be erroneous, and it is clear that there is no pneumonia due to cold; whether sporadic or epidemic, it is always parasitic in origin. The parasite is in the form of an oval micrococcus 1 μ to 1·5 μ long and 0·5 μ to 1 μ broad; it may be separate, or as a diplococcus, or in short chains of four. The capsule described by Friedlander is not regarded by See or Talamon as anything else than the result of the method of preparation. Inoculated into animals it produces common pneumonia, such as is seen in man; in many cases the microbe has extended beyond the lungs, and, by invading the neighboring organs, giving rise to pleurisy and pericarditis of the same nature as the pulmonary inflammation.

Pneumonia, then, may be considered as a specific parasitic disease, which may be reproduced in animals, but cannot be brought about by physical or chemical irritations introduced into the lungs. It may be absolutely distinguished from such other forms of acute inflammation as bronchitis or broncho-pneumonia, for in them microphytes play but a secondary role, and the first cause of them is cold. Parasitic pneumonia has a regular and definite course, just like erysipelas; its duration does not extend over nine days; for a week there is fever, which then suddenly dies down.

In fine, the course of the disease is cyclical. See has found that *antipyrine* is a specific, and that it is well to support the strength of the patient by alcohol.—*Jour. Royal Microscop. Soc*

In France some experiments have recently been made in supplying cows with cold and warm water to test the effect on them as milk givers. The food given was the same in both cases, but it was found that those supplied with water heated to 113° F. yielded one-third more milk than those given cold water.

Finger Arithmetic.

Herr J. Menges describes, in a recent number of *Globus*, says *Nature*, the language of signs employed in trade in Arabia and Eastern Africa. This appears to have been invented to enable sellers and buyers to arrange their business undisturbed by the host of loafers who interfere in transactions carried on in open markets in Eastern towns, and it enables people to conclude their business without the bystanders knowing the prices wanted or offered. It is especially in use in the Red Sea, and its characteristic is that beneath a cloth, or more generally part of the unfolded turban, the hands of the parties meet, and by an arrangement of the fingers the price is understood.

If one seizes the outstretched forefinger of the other, it means 1, 10, or 100; the two first fingers together mean 2, 20, or 200; the three first, 3, 30, or 300; the four, 4, 40, or 400; the whole hand, 5, 50, or 500; the little finger alone, 6, 60, 600; the third finger alone, 7, 70, 700; the middle finger alone, 8, 80, 800; the first finger alone and bent, 9, 90, 900; while the thumb signifies 1,000. If the forefinger of one of the parties be touched in the middle joint with the thumb of the other, it signifies one-half, and if the same finger is rubbed with the thumb from the joint to the knuckle it is one-fourth more; but if the movement of the thumb be upward to the top instead of downward to the knuckle, it means one-fourth less. An eighth more is marked by catching the whole nail of the forefinger with the thumb and finger, while the symbol for an eighth less is catching the flesh above the nail, *i. e.*, the extreme tip of the finger, in the same way.

It will thus be seen that, by combinations of the fingers of the seller and buyer, a large range of figures can be represented. It is, of course, understood that average market value of the article is roughly known, and that there can be no confusion between, for example, 1, 10, 100, and 1,000. This language of symbols is in universal use among European, Indian, Arab, and Persian traders on the Red Sea coasts, as well as among tribes coming from the interior, such as Abyssinians, Gallas, Somalis, Bedouins, etc. It is acquired very rapidly, and is more speedy than verbal bargaining; but its main advantages are secrecy and that it protects the parties from the interruption of meddlesome bystanders, who in the East are always ready to give their advice.

Heat Consumed in a Blast Furnace.

Hanns von Jueptner, an Austrian metallurgist, has contributed to the *Chemiker Zeitung* the results of an experiment to draw up a balance sheet of the heat supply and consumption of a charcoal furnace. During the week in question the furnace was charged with 249·6 metric tons of ore, 6 tons of scrap, 26·1 tons of limestone, 106·48 tons of charcoal, and it produced 114·6 tons of pig iron, 64·6 tons of cinder, 3·275 tons of dry flue dust, and 6 tons of scrap. The average temperature of the blast was 350° Celsius; the average temperature of the gases, 127°; the mean blast pressure, 60 mm. of water; and the diameter of the nozzles of the tuyeres, 55 mm. After giving in detail the analyses, computing to a basis of 10 tons of pig iron, and calculating the heat consumed for the different purposes, Herr von Jueptner makes the following balance sheet:

A.—HEAT PRODUCED.

	Calories.	Per cent.
Hot blast	3,055,398·2	9·23
Hot materials	87,127·3	0·26
Produced in furnace	29,940,736·0	90·51
Total	33,082,736·5	100·00

B.—HEAT CONSUMED.

	Calories.	Per cent.
For chemical processes in furnace	16,521,893·5	49·94
For evaporation of moisture in stock	2,545,978·8	7·69
For melting pig and cinder	5,743,730·0	17·36
Loss of heat by dust	24,456·3	0·07
Loss by heat conducted and radiated	6,447,447·6	19·51
Loss by waste gases	1,799,230·3	5·43
Total	33,082,736·5	100·00

Measuring Heights of Trees.

A writer in *The Garden* reproduces an old but convenient method of ascertaining the height of a tree as follows:

Suppose I want to find the height of a tree which throws a shadow of 20 feet. In the first place, I should cut a stick, say 3 feet long, stick it up opposite the required tree, and measure the shadow of it. We will suppose the stick throws a shadow of 2 feet; now all I have to do is just to make a simple proportion sum of it.

Shadow of stick : Shadow of tree :: Height of stick

2 feet : 20 feet :: 3 feet

3

2) 60

30

The height of the tree throwing a shadow of 20 feet would be 30 feet; because as 2 feet is to 3 feet, so is 20 feet to 30 feet. By this method you can measure any tree that the sun shines upon, provided there is nothing to hinder measuring its shadow.

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Utilizing the Power of Niagara.

Mr. Benjamin Rhodes, C.E., in an interesting paper read last year before the annual convention of the American Society of Civil Engineers, says:

The power of Niagara can be estimated very approximately. The average flow of the river, according to the many careful measurements of the United States Lake Survey, is 275,000 cubic feet per second; total height of the fall, 230 feet; total power, seven million horse power.

To utilize this amount of power by water wheels, generate electrical currents, and transmit to various cities within 500 miles, would necessitate a plant representing at least five thousand million dollars. Such figures as these give some idea of the enormous amount of power here in reserve.

The greatest power now in use at Niagara lies outside of the State Park. The hydraulic canal is a work of great importance. It was constructed about 1855, and is cut through solid rock across the peninsula on which the village of Niagara Falls is built, taking the water from the extreme head of the rapids and discharging below the Falls, giving opportunity to use the entire head of 230 feet. The lower end of the canal is at such a distance from the Falls that the "busy roar and hum" of the factories will be quite unheard by the romantic visitors, who see only beauty, not utility, in the great cataract. The canal is nearly one mile long, and was planned 100 feet wide and 10 feet deep. It has been excavated but 70 feet, and half the distance only 35 feet wide, and is at present partially filled with debris, being at certain points no more than 5 feet in depth. At the lower end is a basin nearly at right angles to the canal, which may be extended as needed along the river frontage belonging to the Hydraulic Power Company. The canal lay idle for a quarter of a century, and it remained for an enterprising citizen of Buffalo, possessed of large capital as well as zeal, to open up the great power to the world. At the time of his purchase in 1878, there was only one water wheel on the canal. There is now a large and increasing number of buildings for manufacturing purposes distributed along the high bank of the river, using an aggregate of nearly or quite 5,000 horse power. The wheels in these buildings are set under heads of from 50 to 100 feet, and discharge the tail water over the side of the precipice, the various streams falling over 100 feet to the river below, making a sight of rare beauty, but suggestive to the engineer of great loss of power. Some of these wheels are of large size when the head is considered, several being capable of giving 1,000 to 1,500 horse power each. The use of wheels of so great power was a step in advance of anything previously attempted in this line, and, as in all cases where there is lack of experience, difficulties were met. Without going into detail, it will suffice to say that fragments of water wheels may be found in the vicinity of all the wheel pits where high heads are used, and that water wheel manufacturers seem to be learning a lesson long ago taught to bridge builders—to use no cast iron. The last few years have seen great improvements in the making and setting of wheels, and the working of all the mills is now regular and continuous.

Further development of power at Niagara may be largely made at moderate expense. The hydraulic canal can be deepened and widened to keep pace with the demand for power, and with further experience wheels may be set under greater heads; the total amount thus made available here being equal to the necessities of many years. It may safely be said that the use of Niagara has just begun. Low water is unknown, troubles from ice are slight, hours of use are not limited to 8 or 10, but 24 hours in the day and 365 days in the year unlimited power is ready, making this the most reliable as it is the grandest water power in the world.

The rental of power at Niagara Falls, in large quantities, may be assumed at $10 per horse power per annum delivered on the shaft. Mr. Rhodes shows there would be no difficulty in transmitting power from Niagara to Buffalo, for electrical purposes, and that the saving over steam on a plant for 1,000 arc lights would amount to the snug sum of forty thousand dollars yearly.

He further shows that the power of Niagara can be transmitted to a distance of 25 miles, with a great saving over the power of steam, and that with improvements in storage batteries and electromotors, this distance can be increased with economy to 100 or 150 miles. With further improvements in dynamos and insulating material to permit the use of currents of higher intensity, such as may be confidently looked for, the economical distance may be still further increased, until some of the present generation may see the prophesy of Sir William Thomson literally fulfilled, and the power of Niagara used in all the large cities of this country.

ACCORDING to "Science pour Tous," hay fever and *coriza a rosarum odore* can be traced as far back as the 16th century.

Test Types.

An interesting paper concerning test types was read by Dr. W. S. Dennett at the Ophthalmological Society, which met at New London last month. Attention was called to the fact that the test type ordinarily in use was inaccurate for the purpose of testing visual acuteness. Of the ten or dozen letters of equal height composing a line on the test card in general use, some, with an emmetropic eye, can be seen clearly at half the distance of others. Oculists up to the present time have been testing eyes at a fixed distance, not understanding the distance value, so to speak, of each of the letters. This has been determined by Dr. Dennett after a series of experiments performed in the following manner: The light was excluded from a bowling alley except that given by Edison lamps, whose illumination was so arranged as to give an equivalent of one candle power at a distance of ten centimeters from the type. The letters were made of India ink on white paper. Each letter was properly arranged, and the observer slowly advanced to the place where he could distinguish it from one or two of those it most resembled, and with which it was most likely to be confused. This plan was found to work better than exploring all the letters at once. The result was, A, L U, V, and I were always seen at the greatest distance, and B and S at the least.

As a result of these experiments, Dr. Dennett exhibited to the Society a test card on which were displayed letters of a size made in accordance with mathematical laws, to give them all a uniform value.

It is not a little singular that it should have been left until to-day to make the demonstration of the inaccuracies of a test which has been constantly employed by oculists for twenty years.

It may be remarked that many who make the eye a specialty have recognized the fact that some letters of the same size are much more easily distinguished by patients than others, but Dr. Dennett has discovered the true scientific reason, and has placed the matter on a basis of physics and accuracy.—*Medical Record.*

Lime and Clinker Bricks.

A further communication upon the utilization of clinkers has appeared in the *Genie Civil.* M. Gouvy has described the treatment of clinkers in a factory in Meurthe-et-Moselle, where this economy appears to have been highly developed. Here the clinkers from all the furnaces of the establishment are passed through a revolving screen, which separates them into dust, nuts, and large pieces. The dust is used in brick making, and the nuts are washed in order to recover the small pieces of coke mixed with them. The coke saved in this way is equivalent to from 4 to 5 per cent of the total consumption of coal in the furnaces. The dust already mentioned is ground up in a mortar mill with slaked lime, in the proportion of 10 to 3, and the mixture is pressed into bricks by a machine. These bricks are merely air dried, and are capable of being used for partition walls or paneling, or any position in which they are not subject to heavy loads. About 2,500 bricks are made from a cubic meter of lime, and the cost of the bricks (not counting the clinker dust as of any value) is about 11 d. per 100. The bricks gain strength with age, and should be made six or seven months before use. A great proportion of the works buildings has been constructed of this material.

The machine used to compress the bricks is a specially designed apparatus, consisting simply of a brick mould for the mixture, placed in a frame under a monkey weighing about 200 pounds, which, like that of a piledriver, can be raised to the top of the frame and dropped upon the mould. A belt and pulley give continuous revolution to a shaft across the top of the frame which carries a drum; and the monkey is raised simply by the workman holding on the fall of a rope which is made fast to the monkey and passes over the drum. By this means the moulder can graduate the force of the compressing blows of the monkey upon the mould by loosing the rope at any desired height. The block, after having been moulded, is removed by a foot lever raising it out of the mould. A man and a boy are sufficient to attend to the machine. The pale gray color of these lime and clinker bricks is admired as a relief to the ordinary red clay bricks made in the same district.

Warehouses Found at Rome.

An interesting discovery illustrating the commerce and the luxury of ancient Rome has been made close to Monte Testaccio and the English cemetery. The whole of that district to the west of the Aventine outside the Porte Tragemina was occupied by granaries and warehouses for the storage of imports of all kinds. Between the northern side of Monte Testaccio and the Tiber there still exist colossal remains of the great emporium built by Marcus Emillius Lepidus and Emillius Paulus nearly 200 years before the Christian era. In the year 1868 a considerable portion of the quays was discovered, together with some six hundred blocks, many of them of large size, of rare, variegated marbles of all kinds, lying just where they were landed from the galleys which had brought them from Numidia, the Grecian Islands, and Asia Minor fifteen centuries ago.

Now, in the course of the building operations in this locality, two warehouses have been discovered, one filled with elephants' tusks and the other with lentils. It is curious to find such products stored side by side, but as bags of lentils were sometimes shipped as ballast, they may have served that purpose. The discovery would have been a very valuable one if, unfortunately, the ivory had not been much decayed. The *Popolo Romano* states that it is the intention of the Syndic to remove the bronze equestrian statue of Marcus Aurelius from the piazza of the Capitol to a museum, and to erect a bronze reproduction in its place. The reason for this change is scarcely apparent. The statue certainly does not occupy its original position, but, to employ Michael Angelo's opinion of it, it is a "living monument of ancient Rome."

It has stood in the sight of the people—one might almost say of the world—for more than 1,700 years; and although the gilding has nearly disappeared, it has in other respects suffered no injury during this lapse of years. It endured much rough handling in the course of removal, and when wine was made to flow from the nostrils of the horse in the time of Rienzi. Standing where it does, it forms an integral part of the ancient magnificence of the city, and affords a vivid illustration of its splendor; but removed to a museum it will simply be part of a collection of works of art.—*London Times.*

Improvement in the Uses of Chloroform.

According to *La Nature*, experiments have shown that the vapor of thirty grammes of chloroform, mixed with a hundred liters of air, will kill a dog in a few minutes; while a dose three times as strong, if diluted with a cubic meter of air, produces a sleep without danger, lasting two hours. The tension of the vapor, rather than the quantity, determines the effect; but the operator, in administering the anæsthetic, has to take into account the quantity; so that, under apparently the same conditions, very different results are obtained; and hence arises the difference of opinion among surgeons as to its use.

Six grammes in a hundred liters of air have very little effect upon a dog; ten grammes produce insensibility for an hour and a half; while fourteen grammes cause death in forty-five minutes, and twenty grammes in five minutes. In the case of man, with an inspiration of half a liter, these results are produced by three, five, seven, and ten centigrammes of chloroform respectively. It will be seen that the difference between the harmless and the dangerous proportions is very slight. Accordingly, the use of choloroform has always been considered dangerous; and in order to make it less so, Mr. Paul Bert has made experiments upon animals, and afterward applied them to man. His experiments with man have extended over two hundred cases, including patients of all kinds of temperaments, with always the same result. He uses ten grammes of chloroform vaporized in a hundred liters of air—a dose agreeable to some, and to none disagreeable. The most disagreeable effects of the anæsthetic have always been felt in the period of repulsion; but Mr. Bert almost entirely removes this. The period of excitement is not great, and only lasts from one to two minutes; while in the case of more than one-third of the adults it is entirely absent. The pulse is a little accelerated during the period of excitement, but remains perfectly normal and regular during sleep. Complete insensibility is produced in from six to eight minutes, and is maintained during the whole time of respiration. After the patient becomes insensible, the quantity of chloroform is reduced to eight grammes, and later to six. Painful operations have no effect, except that the respiratory movements are slightly accelerated. There is no nauseation, and the amount of chloroform administered is not enough to cause poisoning; while there is no fear of asphyxia, for the amount of oxygen is reduced only by a hundredth. Indeed, with the exception of cerebral congestion and faintings, none of the ordinary dangers need be feared.

Another Electrical Exhibition in Paris.

The project for a new electrical exhibition in Paris has been announced. It is to be held next spring, and will be organized by the International Society of Electricians. Probably it will be a second edition of the exhibition held at the Observatoire a few months ago, with all the modifications and extensions that may be dictated by experience. It is intended to obtain a more central and convenient locality, and to make a special feature of electrical experiments and demonstrations, which will certainly insure for the undertaking a large measure of popularity.

ITALY seems to experience some difficulty in getting the 121 ton Krupp guns transported to points where they are wanted. They require, in the first place, a 39 ton car for their transportation, and the railways and bridges are not strong enough to bear the great weight, so the authorities are in a dilemna.

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The Art of Printing.

We may trace the footprints of creation in the enduring rocks that underlie the earth's surface. The physical world bears the imprints of the Almighty Hand by which it was created; and reading this wondrous page in the light of modern science, curious inquiry is ever encouraged by new discovery to fresh research. Even the birth of man, and the manner of his coming into this world of ours as an animal, is now a problem of which many claim to hold the key. They can even speculate shrewdly as to when this animal became the proud possessor of that intelligence which distinguishes him from his humbler fellow creatures—when man began to think.

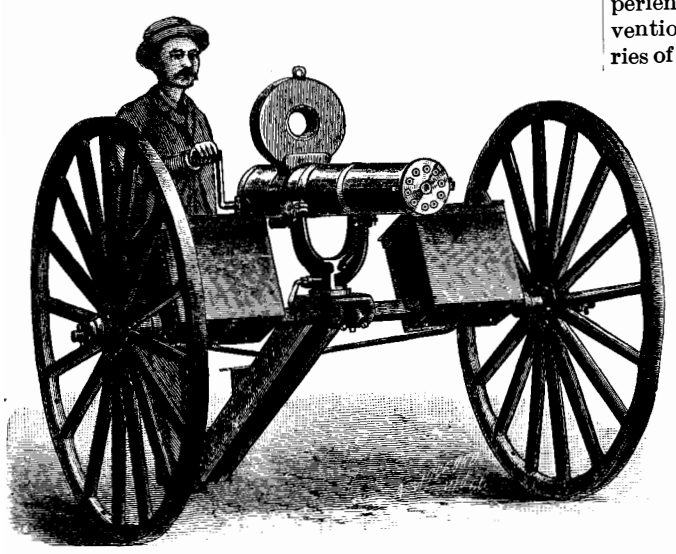

Fig. 1.—GATLING GUN MOUNTED ON U. S. A. MODEL CARRIAGE.

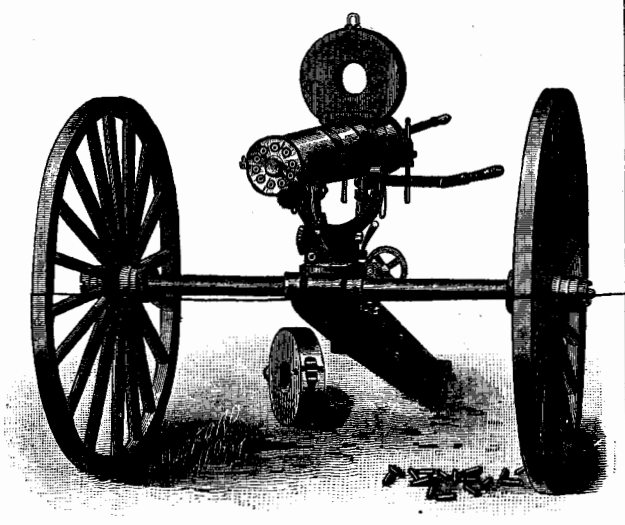

Fig. 3.—GATLING GUN SHOWING ACCLES' FEEDER.

But there is a point in the world's history from which we may reason with approximate certitude. Beyond, and back of that, all is confusion, doubt, and superstition. Tradition, which transmits its facts by impression upon the shifting tablets of memory; the spoken word, that fades into silence or is lost in the confused babel of tongues, that loses its import on being repeated, is not a trustworthy guide by which to trace the growth of thought. When men began to *write*, thought for the first time began to assume an enduring form. Then books were made, and the mental achievements of one age were handed down as a legacy to the next.

And even the written page, whose words were traced "in the unvexed silence of a student's cell," to be read only by the unquestioning disciple whose highest aspirations were to understand the *dicta* of the sage, whose prodigious wisdom was taken for granted, proved but a halting advance in the world's mental progress. Not until the art of multiplying books by impressions from movable types was discovered, was human thought emancipated for all time. Its first charter of inalienable liberty was the printed page. Books, open to criticism, capable of countless reproduction, render the mental labors of one century as legible to future generations as they were to the age in which they were first given to the world. They live with their truths side by side with their errors. They endure as records of past achievement, and their prophecies are subjected to the test of the world's riper experience. To destroy the results of this wondrous invention, it would not suffice to burn all the great libraries of the world. Nothing less than a flame that would wrap the earth could undo the work of movable types, or blot out the records of human progress. — *B. and C. Printer.*

Poor Prospects for the Panama Canal.

Civil Engineer A. G. Menocal, U. S. Navy, was ordered by Secretary Chandler last fall to proceed to Nicaragua for the purpose of revising the estimates for the construction of the Nicaragua Interoceanic Canal. In compliance with his instructions he had occasion to cross the Isthmus of Panama, and availed himself of the opportunity to thoroughly examine the progress of the work on the Panama Canal. His report to the Secretary of the Navy furnishes additional evidence of the magnitude of the task which M. De Lesseps has undertaken, and of the apparently insuperable difficulties which render so improbable the success of his project. Mr. Menocal finds as a result of his survey that 70 per cent of the whole distance of the canal is as yet untouched, that the excavation is less than 6 per cent of the total cube to be removed, and that as the work has thus far been confined to the surface, these percentages do not represent the proportional cost of the work done, which he estimates at not more than 4½ per cent of the total cost.

Moreover, it is generally conceded that the canal must be protected from the freshets of the Chagres River. This it is proposed to accomplish by the construction of a dam a mile long and from 150 to 170 feet high across the valley of the stream, the hydrostatic pressure at the base of which is estimated at 12,000 pounds per square foot. In this connection the estimates which Mr. Menocal puts upon the entire cost of the undertaking are significant. He says: "It may be safely stated that the canal cannot be completed for less than $275,000,000, exclusive of interest on capital, commissions, etc., in addition to what has already been spent, or a total cash for the actual cost of the works of $375,000,000. Now, to raise this sum of money and the annual cash interest, with the present credit of the company unimpaired, and supposing that the canal will be completed in fourteen years, will raise the obligations of the company to $661,000,000.

AN Æolian harp is an instrument so simple in construction that any boy, unskilled in the use of tools, can make one. Stretch in parallel lines, over a box of thin deal, catgut or wire strings. The box is to have sounding holes cut in the top. The strings being tuned in unison, the instrument is placed in a current of air, and harmony is produced.

THE IMPROVED GATLING GUN.

The accompanying engravings show the improved Gatling gun in various positions, ready for firing. As now constructed, the gun can be fired at any angle, up or down, and is capable of a wide lateral range; it is provided with a positive feed, which is absolutely certain in action, both in placing the cartridges and removing the shells, no matter in what position the gun may be out; in addition, the feed mechanism cannot be deranged by ignorant or irregular handling. Fig. 1 shows a gun, 10 barrels, mounted on the United States Army model carriage, in position ready to fire. In the boxes on the axle are 12 "feeders," holding in all 1,260 cartridges. The second figure shows the depression at which the gun can be fired. Fig. 3 shows clearly a gun having the Accles' positive feeder, one feeder being on the gun ready for firing and the other on the ground. The remaining figures show the gun (6 barrels) mounted on the carriage or tripod ready for firing.

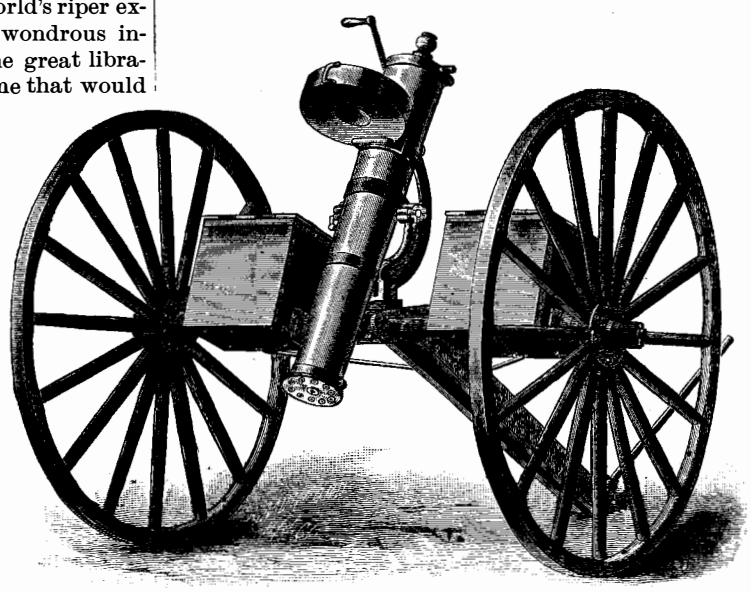

Fig. 2.—SHOWING DEPRESSION AT WHICH GATLING GUN CAN BE FIRED.

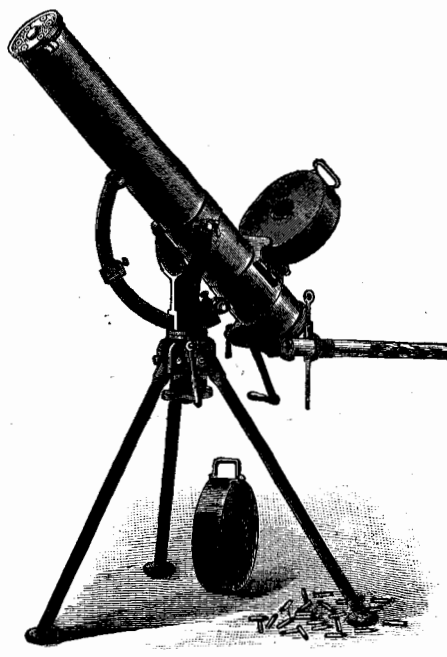

Fig. 4.—GATLING GUN MOUNTED ON TRIPOD.

Usually, the Gatling gun has 10 barrels and 10 corresponding locks, which revolve together during the working of the gun; but in addition to this, the locks have a forward and backward motion of their own. The forward motion places the cartridges in the chambers of the barrels and closes the breech at the time of each discharge, while the backward motion extracts the cartridge cases after firing. The gun is loaded and fired only when the barrels are in motion from left to right. When the gun is in action, there are always five cartridges going through the process of loading and five cartridge cases in different stages of being extracted; the several operations are continuous while the gun is being

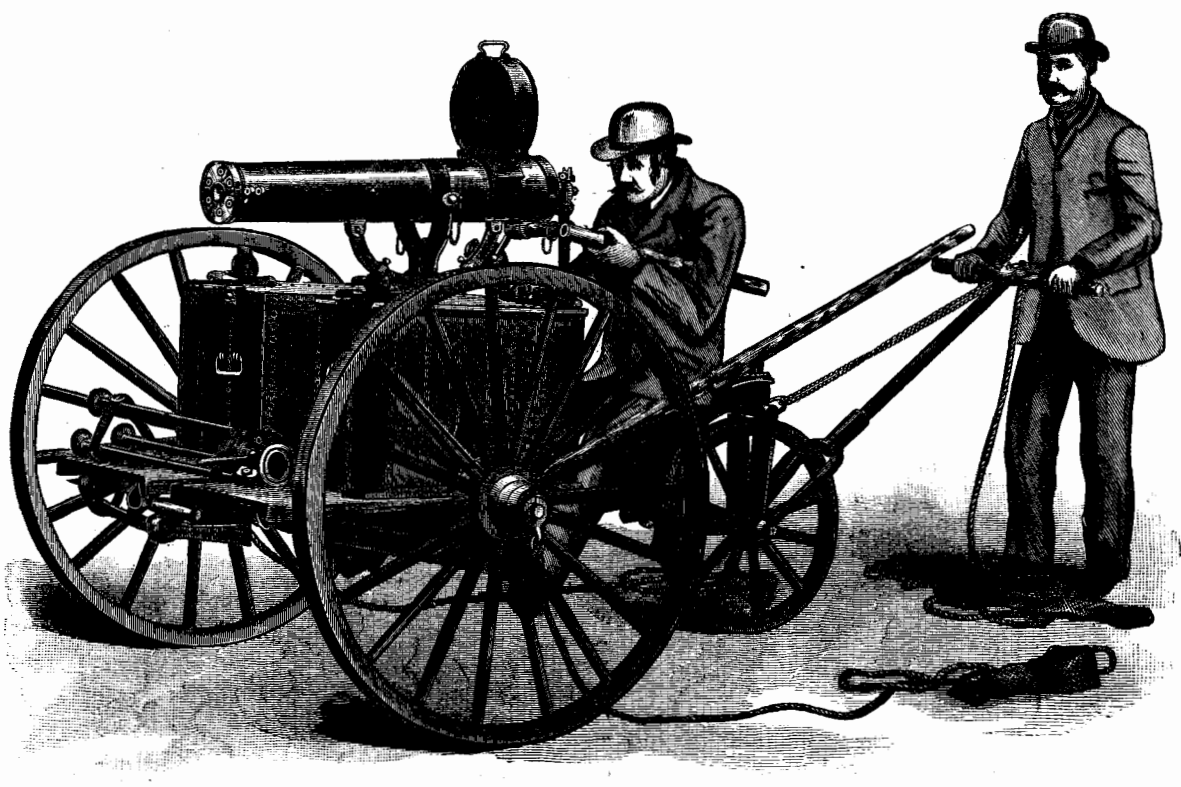

Fig. 5.—GATLING GUN ON CARRIAGE.—FRONT VIEW.

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worked. As long as it is fed with cartridges, loading, firing, and extracting are carried on automatically, uniformly, and continuously.

In the old methods of supplying ammunition to the gun, it was possible for the cartridges to jam in feeding down from the cases into the receiver, but in the improved feed the mechanism never loses control of the cartridges from the time they leave the feed magazine until they enter the chambers, are loaded, fired, and the empty cases extracted. This improvement not only greatly increases the rapidity and certainty of fire, but allows the gun to be fired at the rate of over 1,200 shots per minute, and at all degrees of elevation or depression. By firing the gun at proper elevations, ascertained by means of a quadrant, the bullets can be made to fall upon men behind breastworks or intrenchments at all distances from 200 to 3,500 yards from the gun. Experiments have proved that musket-size balls, fired from a Gatling gun at high angle, strike the ground with sufficient force to penetrate from two to three inches of timber. As about 1,200 shots per minute can be fired, a hailstorm of bullets can be rained on the heads of men behind intrenchments, thus making such positions untenable in a short space of time.

The lock is so constructed that the firing pin does not project in front of the face of the lock until, released from the cocking ring, it flies forward and discharges the cartridge.

The cocking ring can be thrown out of action at will, thereby allowing firing motion, during drill, to take place without snapping and injuring the hammers.

The gun represented in Figs. 4, 5, 6, and 7 has six 30 inch barrels, its whole length being 43 inches. The man who fires the gun points it at the same time, and it can be given an all-round fire, and at the same time elevated or depressed 55 degrees, and oscillated from 0 to 50 degrees. The weight of the gun is 107 pounds, and the weight of the tripod and mount is 47 pounds. The feeders, containing 64 cartridges each, weigh 14 pounds. The time required to fire one feeder is $2\frac{2}{10}$ seconds, and 768 cartridges can be fired in one minute. The number of feeders that can be carried in the carriage is twelve. The cartridges are received from the magazine at the top of the gun, and fired at the bottom. In case of an accident with a defective cartridge, the fire or gas cannot reach the live cartridges in the magazine and thus cause a premature explosion. This renders the gun so safe that it is impossible for an accident to happen to the man handling it. No tools are required to take gun and feeds to pieces. The tripod can be carried on the end of the carriage, as shown in Fig. 5.

The performance of these guns in actual warfare, in direct firing, in "high angle" firing, and in firing down from the foretop of a vessel, has demonstrated their eminent practicability and effectiveness, while repeated series of severe tests have proved their superiority in rapidity of firing, ease of handling, accuracy at all inclinations, and reliability. These guns are made by the Gatling Gun Company, of Hartford, Conn.

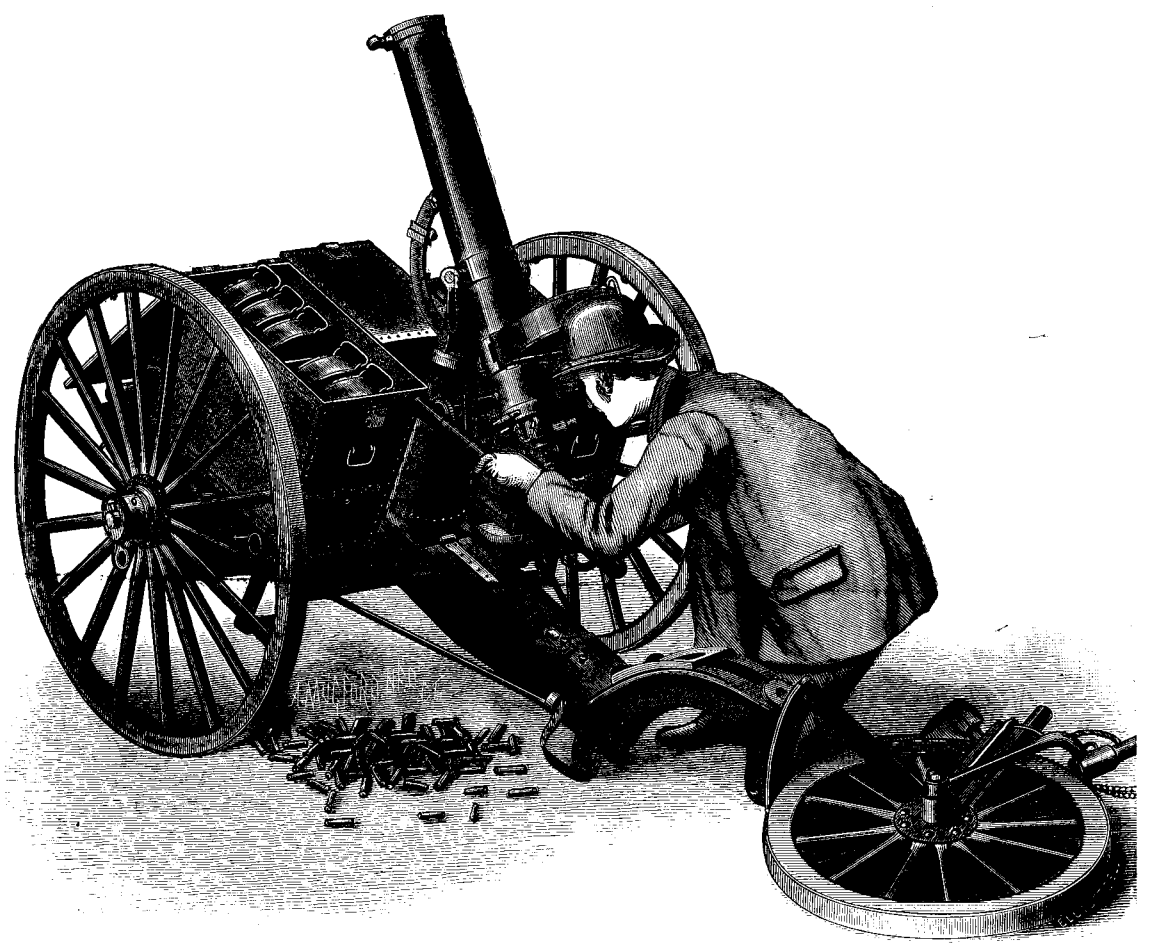

Fig. 6.—GATLING GUN MOUNTED ON CARRIAGE.—HIGH ANGLE FIRING.

Highest Jump of the Salmon.

Prof. A. Landmark, chief director of the Norwegian Fisheries, has, says *Nature*, published some interesting particulars of his studies of the capability of salmon to jump waterfalls. He is of opinion that the jump depends as much on the height of the fall as on the currents below it. If there be a deep pool right under the fall, where the water is comparatively quiet, a salmon may jump 16 feet perpendicularly; but such jumps are rare, and he can only state with certainty that it has taken place at the Hellefos, in the Drams River, at Haugsend, where two great masts have been placed across the river for the study of the habits of the salmon, so that exact measurements may be effected. The height of the water in the river of course varies, but it is as a rule, when the salmon is running up stream, 16 feet below these masts. The distance between the two is 3½ feet, and the Professor states that he has seen salmon jump from the river below across *both* masts. As another example of high jumping, he mentions some instances of Carratunk waterfall, in Reumbec, in North America, where jumps of 12 feet have been recorded. Prof. Landmark further states that when a salmon jumps a fall nearly perpendicular in shape, it is sometimes able to remain in the fall, even if the jump is a foot or two short of the actual height. This, he maintains, has been proved by an overwhelming quantity of evidence. The fish may then be seen to stand for a minute or two a foot or so below the edge of the fall in the same spot, in a trembling motion, when with a smart twitch of the tail the rest of the fall is cleared. But only fish which strike the fall straight with the snout are able to remain in the falling mass of water; if it is struck obliquely, the fish is carried back into the stream below. This Prof. Landmark believes to be the explanation of salmon passing falls with a clear descent of 16 feet. The Professor believes that this is the extreme jump a salmon is capable of, and points out that, of course, not all are capable of performing this feat.

S. WROBLEWSKI says liquid oxygen and nitrogen rank among the most perfect insulators. The resistance of copper decreases much more rapidly than the absolute temperature, and approaches zero at a temperature not very remote from that obtained by evaporating liquid nitrogen in a vacuum.

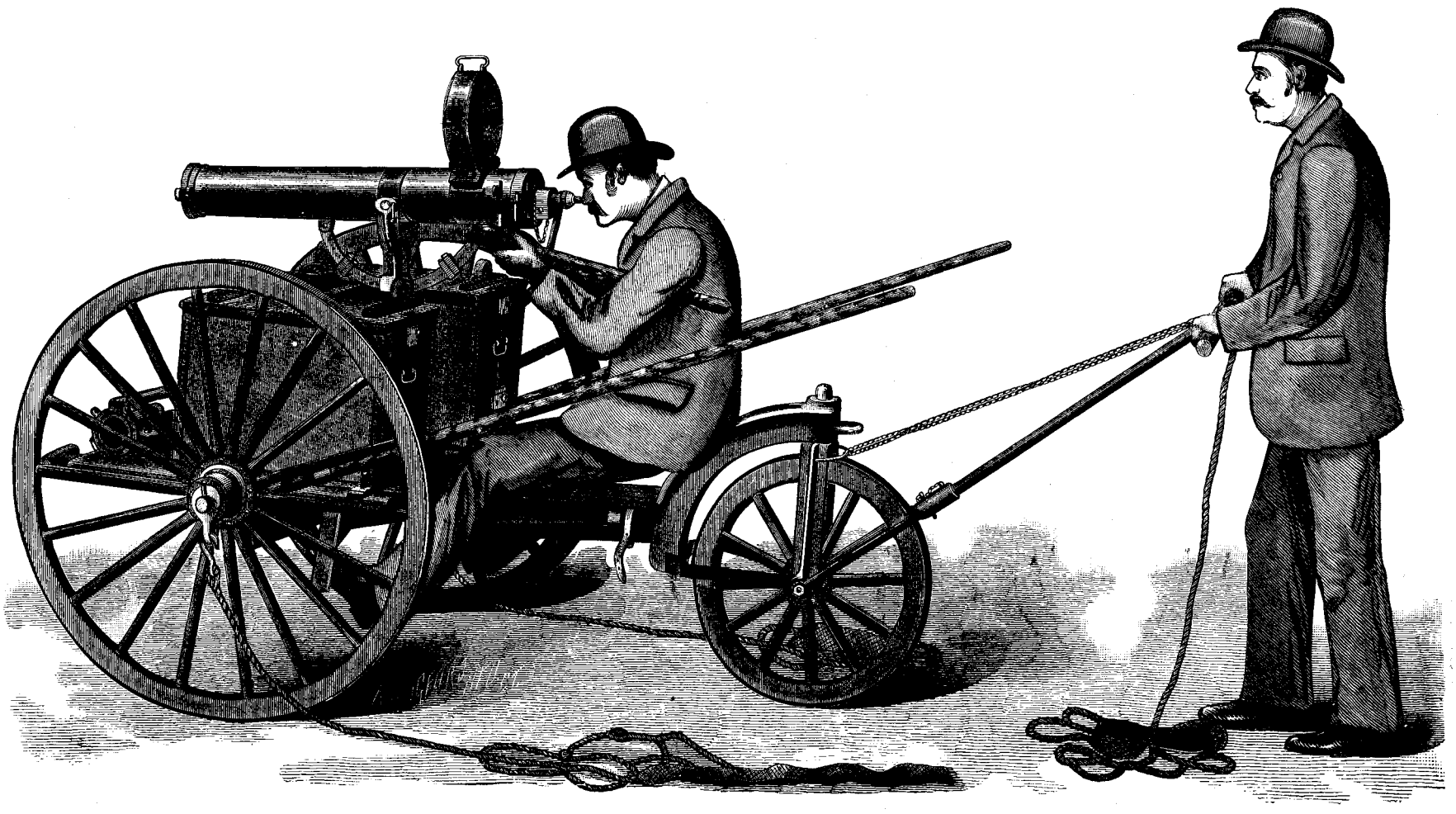

Fig. 7.—GATLING GUN MOUNTED ON CARRIAGE.—REAR VIEW.

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Foundation Walls.*

It is strange that, with all our boasted progress in engineering and practical architecture, we are really little better off than the Romans were in the construction of basement walls that shall resist moisture. In looking over the resources of the builder in such matters, we discover very little that is really new, although modern authors would sometimes have us believe we are greatly in advance of all that pertains to constructive expedients. To take, as an example, the modes by which walls in a damp position and forming a basement may be built. The hollow or cavity wall is not new. Vitruvius, writing 25 B.C., says: "If a wall is liable to continual moisture, another thin wall should be carried up inside it, as far within as the case will admit, and between the two walls a cavity is to be left, lower than the level of the floor of the apartment, with openings for the air at the upper part, also openings must be left at the bottom; for if the damp does not evaporate through these holes above and below, it will extend to the new work. The work is then to be plastered with the 'potsherd' mortar made smooth, and then polished with the last coat."

We have here a most perfect description of the best principle upon which hollow walls can be built, and the explanation given of the use of the openings for evaporation describes in the most scientific manner the reason of the failure of many modern hollow walls. How few builders of such walls take care to make the cavity extend below the level of the floor, or see that openings are left! When there is no space for another wall, Vitruvius recommends a construction of hollow tiles placed against the outer side of the wall, with channels leading to the open air. He says: "Then tiles of the size of 2 feet are placed on one side of the channel, and on the other side piers are built of 8 inch bricks, on which the angles of two tiles may lie, that they may not be distant more than one palm from each other. Over them, other tiles with returning edges are fixed upright from the bottom to the top of the wall, the inner surface being carefully pitched over that they may resist the moisture; they are to have air holes at the bottom and top above the vault," etc.

Such is the description which is illustrated in Perrault's French edition of Vitruvius' treatise. The tiles spoken of may be more clearly understood if we call them trough-like in section (⌴), these being laid endwise so as to form a series of square openings up the wall to be protected, the bottom course resting on brick piers, having below a gutter or drain between them and the wall. These vertical terra cotta or stoneware tiles are placed with their unclosed side against the wall, the inner edges of which are pitched. Though there have been several similar modern tiles made upon this plan, we do not think they are so simple—and they are certainly seldom employed. The Romans constructed their camps with due regard to dryness. When the wall was exposed to the ground on one side, the hollow wall was introduced. The concealed area is no new invention. The camp of Adrian at Tivoli showed a double wall. We read of walls being constructed in three sections, the outer and inner walls built of regular courses, and the center cavity filled up with small stones without mortar, which served the object of a drain. The inner and outer walls were cramped with iron.

The concealed area is still a good plan for protecting the outside wall from dampness, but is very seldom adopted. The area may form a drain, intercepting the moisture from the soil and carrying it away, or it may be simply a passage covered in below the ground level outside the building. The area may be covered at the top by a semi-arch, cemented or asphalted at the top to form a watershed just below the surface, perforated tiles or bricks being introduced for ventilation. The area bottom should form a drain to intercept and carry away the moisture.

Another form of concealed drain is that of an egg-shaped sewer, with openings left in the outer wall of area, for the moisture from the earth. The invert and inner wall can be built of concrete, and the sloped watershed over the arch can be also of this material. Viollet le Duc describes a similar method of protection, composed of a slanting top of concrete to throw off the surface water from the building, and slits in the side wall of area for intercepting the water, and a hollow invert or bottom of concrete for conveying it away. But there are simpler methods. A cheap method of treating outer walls exposed to dampness is to excavate a trench twice as wide as that required, the space between the outer face of wall and the excavation to be filled with broken stone or bricks. The "filling" then performs the office of an intercepting drain.

Such a treatment is not sufficient for porous stone or brick walls, and some other precaution becomes desirable. In addition to the rubble drain, the outside of wall may be protected by a thin wall of bricks bedded and faced in asphalt, or the Hygeian composition, commencing from the damp-proof course and extending upward above the surface of the ground. The cellar floor should also be paved with asphalt. The drain or bottom of external excavation, filled with rubble, is better made below the footing of the wall, so that the water should not unnecessarily be brought into contact with the wall; a tile drain of small diameter laid below the footings may be of service. Sometimes the interior wall is built of brick to form a hollow, allowing an air space of about 2 inches to 4 inches. A good plan is to make the outer face of wall above the ground overhang the wall below, by which means the water trickling down is arrested and cut off by the outer filling. Projecting sloped tiles of stoneware may be introduced into the joints above the ground level for the same purpose. Such a tile course forms a useful watershed to throw the water off from the wall, and where hollow tiles are used as a wall casing such as we have described, its use is of great moment in covering the upper openings.

By the combined means of asphalt for damp roof courses and facings, and dry areas or hollow walls, there is no difficulty in making an underground cellar perfectly impervious to moisture. The chief points are in taking care to have the hollows or areas sufficiently below the level of floor, to make the coating of asphalt continuous from the cellar floor through the wall, and to the surface of ground outside. The ties used for hollow walls are various. Iron ties, of cast and wrought iron, if galvanized or coated with pitch or asphalt, serve the purpose admirably, though several kinds of brick ties are manufactured, which give a good tie without breaking the bond, and prevent the passing of moisture along the upper surface of the brick. Wedge-shape ties are also made. There are a variety of cheap wall linings made of enameled or glazed bricks, terra cotta slabs, glazed stoneware, and compounds of different kinds. Tile facings and damp-proof courses afford a very inexpensive means of arresting the moisture, and providing a good substitute for a dry area or hollow wall. Simple and, in some cases, efficient protection is rendered by watersheds constructed along the exposed wall, and slanting downward at a certain angle some 3 feet or 4 feet in projection; it may be of a course of brick asphalted, the first course being grooved into the wall. But a well sloped pavement of asphalt answers the same purpose of protecting underground walls. Wherever it can be built, however, an open area next the basement wall is the healthiest mode of making a dry lower story. Open to the light and air, they are purifying as well as protective, but in every case should be provided with a drain to carry off the surface water.

* *The Building News.*

New Process of Photo-Engraving.

BY H. REINBOLD.

Though the processes of Meisenbach and Ives have given splendid results, they are too expensive and too uncertain. In the Meisenbach process three photographic plates have to be made, and, as a matter of course, this makes it slow, dependent on the light; and as many of the fine details are lost by copying the subject three times, most of the plates have to be worked over with the tool.

As is well known, the above-named processes of producing photo-engravings from nature, so as to give it the appearance of a photograph, are based on the dissolution of the photographic tints into dots and cross lines.

The inventor of the process described herein has long experimented with the Meisenbach process, and has been a practical photo-engraver for several years. But all the various methods he tried did not prove satisfactory, and at last he tried to find a method of producing a plate which will print on the printing press, and give the engraving the appearance of lichtdruck or heliotype. The method is simple, and the cut prints clear.

It is known that gelatine, if mixed with bichromate salts, will be tanned and get hard or insoluble if exposed to the sunlight, because the light decomposes the bichromate salts, and the liberated chromic acid sours the glue. The amount of bichromate salts mixed with the gelatine, together with the manner the gelatine is dried, makes the fineness of the grain when the gelatine is put into water, as the bichromate not only decomposes in the light, but also heat and the oxide of the air have some influence on it, and part of the chromic acid, which is the tanning agent, is freed.

The less bichromate salts is used, the grain will be finer; the same as is the case when the gelatine is dried slowly. But there are other means of getting a fine grain on a gelatine surface. It was found by experimenting that this way of producing a grain was not practical, the grain is too narrow, and therefore the plates have not enough contrast; the pictures look flat and dead. There were also difficulties in printing it. The grain must be open to produce more contrast between the lights and shadows, the more as it is impossible in this process to get any high lights at all.

Here is the description of the process: Pieces of clean plate glass are leveled in a dark room, and spread with a solution of:

10 parts of water,
2 parts of silicate of soda,
5 parts of albumen,
¼ part of thymol, well mixed and filtered.

Set the plates up on one corner until they are dry; then cover them with the following mixture:

10 oz. water,
1½ oz. Nelson's X opaque gelatine,
4 oz. bichromate of ammonia.

A few drops of chromic acid, glycerine, and carbolic acid. The gelatine must be soaked first for fifteen minutes, and when it has taken up all the water it is heated, but not boiled. Then add the glycerine, the bichromate ammonia, and the acids. Before the solution is put on the plates, add ¾ of an ounce of best glacial acetic acid, filter, and cover the plates. These should then be dried in a heat of about 90 degrees, when they are ready to be used. Put as much solution on the plates as they will hold.

The negatives or positives have to be well intensified by the use of sulphide of copper and bromide of potash solution, and nitrate of silver afterward. The darkest parts in the negative should be perfectly black and untransparent; but care should be taken not to intensify too much, as then the details in the light parts will be lost. The success of the method depends largely on the negative used. No dry plates should be used in this process.

When the negative is ready, it must be laid upon the gelatine plate, and is exposed under a printing frame for fifteen minutes in full sunlight, and thirty-five or more in dispersed light. When the transparent parts of the negative get perfectly brown, the plate is taken out and put into warm water of about 50 degrees, in which tannic or gallic acid has been dissolved, and left in it for five minutes. Then it is taken out and put into cold water which contains subsulphide of iron. In this it may be left for hours, and even days if desired.

From the plate obtained in this way a plaster cast is produced, and from this an electrotype. Sometimes it happens that the plate is not quite as deep as it should be, the cause of which lies in the change of the temperature, the moisture of the air, and the qualities of the chemicals. In this case the electrotype is inked over with lithographic ink, with a fine roller, and when all details are up it is covered with a solution of sesquichloride of iron in 90 degrees of alcohol, and left in it for five minutes. It is advisable to spread the solution on the electrotype with a fine camel's hair brush. The iron etches the copper to any desired degree, but it should not be left on too long, as the picture may be hurt when it is put under heavy pressure. The process has given very good results, though there is no doubt that there is a chance for further perfection.

Protection against Lightning.

Mr. Calladon recently, addressing the French Academy of Sciences, said that there was no truth in the popular supposition that a building with a metal roof, or with metal in its construction, is more likely to be struck by lightning than a building composed wholly of non-conducting materials, provided there is no means of electric communication between the metal and the earth. A house in Neufchatel, Switzerland, had been struck by lightning and burned, and somebody suggested that a lot of old iron stored in the attic had attracted the electric fluid. It was this suggestion that brought Mr. Calladon to his feet. He said that the iron had had nothing to do with attracting the lightning, but had probably been a cause of the burning of the building after it had been struck. The explanation of that is that a combustible substance placed between two conducting surfaces (in this case the humid atmosphere and the pile of iron) is generally sure to take fire when an electric current is passed through it from one conducting surface to the other. The lightning having struck the house, concludes the scientist, it found its way to the metal within, and ignited whatever combustible material it passed.

Gold in Michigan.

Announcement was recently made of the discovery of a vein of gold-bearing sugar quartz on section 35, town 48, range 28 west, Michigan. The property on which the discovery has been made belongs to the Lake Superior Iron Company. The correspondent of the Detroit *Free Press* says that this gold boom is no heedless clamor of inexperienced men. The men who are backing it are miners of experience. Assays have been made which show well. Average pieces taken from among the best specimens gave $8,965 in gold and silver, nearly all being gold. These choice specimens varied in weight from six ounces to as many pounds, and this was their average value. The second assay was made from the leanest piece of quartz which could be found in the rock taken from the vein. In this there was no free gold visible to the naked eye or distinguishable with the aid of an ordinary prospector's pocket glass. It gave $62.64 to the ton, nearly all in gold also. It is said that a vein of this quartz four feet wide has already been traced over seven hundred feet.

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Eatables on Ocean Steamers.

Few persons are aware of the extensive nature of the victualing on board the great ocean steamers. Such a vessel is provisioned as follows for the passengers and crew: 3,500 lb. of butter, 3,000 hams, 1,600 lb. of biscuits, exclusive of those supplied for the crew, 8,000 lb. of grapes, almonds, figs, and other dessert fruits; 1,500 lb. of jams and jellies; tinned meats, 6,000 lb.; dried beans, 3,000 lb.; rice, 3,000 lb.; onions, 5,000 lb.; potatoes, 40 tons; flour, 300 barrels; and eggs, 1,200 dozen. Fresh vegetables, dead meat and live bullocks, sheep, pigs, geese, turkeys, ducks, fowls, fish, and casual game, are generally supplied at each port, so that it is difficult to estimate them. Probably two dozen bullocks and 60 sheep would be a fair average for the whole voyage, and the rest may be inferred in proportion. During the summer months, when traveling is heavy, 25 fowls are often used in soup for a single dinner.

GREENHOUSES AND CONSERVATORIES.

The time of year is now approaching when many who have been experimenting with the cultivation of plants or flowers during the past season bethink themselves of the possibilities of continuing, and perhaps enlarging, their work during the winter months, provided their means go hand in hand with the tastes which this pleasurable occupation usually begets, while others who have before done something in this line should not longer delay the making of contemplated enlargements and improvements. To all such the design herewith presented, of an English country house and conservatory, will afford suggestions for a roomy, highly ornamental, and yet not very expensive structure, which may be used both to raise and display plants. The chimney, built into the side of the house, suggests where the furnace should be placed, and in the most convenient place for so dividing the interior, either by permanent fixtures or sliding partitions, as to get the different temperatures required for various plants. A cool greenhouse is one intended simply to protect tender plants during the winter season, and the temperature may be as low as 35° to 40° F., but plants are not expected to grow in such a house; for flowers the day temperature must be at least 60°, with a minimum of 40° at night. It is evident that an abundance of light and ventilation are afforded by a conservatory of the design herewith shown. For heating such houses, the plan now most generally adopted is by hot water flues, though formerly, and at present in some of the smaller houses, the furnace flues alone are used, conducted around the house before entering the chimney. In the hot water system a pipe runs from near the upper part of the furnace hot water reservoir all around the house, under the different benches holding the plants, and returns to the boiler near its lower part, the fire in the furnace causing a constant circulation. A house constructed as the one shown gives great opportunities for display as well as for the cultivation of plants requiring different temperatures.

AN ORNAMENTAL CONSERVATORY.

The Nutmeg Plant—Myristica (*Var. Sp.*).

BY F. L. S.

ANALYSES OF NUTMEG.—(*M. fragrans.*)

	Ordinary kind. Bonastre, 1823.*	Ceylon nutmegs. 1880.
Volatile oil	6·0 per cent.	8·21 per cent.
Liquid fixed oil	7·6 "	35·76 "
Solid fat	24·0 "	
Acid	0·8 (?) "	....
Starch	2·4 "	1·85 "
Gum, etc	1·2 "	
Nitrogenous matter	..	6·70 "
Mineral matter	..	6·23 "
Cellulose and loss	54·0 "	33·73 "
Water	.. (?)	7·52 "
Loss	4·0 "	..
	100·00	100·00

The volatile oil of most species of *Myristica* seems to vary but slightly as to composition and physical characters, although it differs widely as to quantity. Some (Bentley and Trimen) assert the yield at "2 to 3 per cent," but the true nutmeg normally contains a great deal more than that, the wonderfully aromatic "nut" of Ceylon containing nearly 8¼ in 100 parts. The specific gravity of this variety is stated to be 0·927 by the author of the 1880 analysis, but from 0·920 to 0·948 has been named as the extreme limits, or range. *Myristicene*—a hydrocarbon—stated by Cloetz to constitute about three-quarters of the ordinary oil, but Dr. Gladstone has detected the presence of a small quantity of an oxygenated product, isomeric with menthole; for this the name of *Myristicole* is suggested. It appears to have the same properties as menthole when locally applied for the relief of neuralgia, etc.

The expressed oil of nutmegs—*Oleum Myristicæ Expressum*, or nutmeg butter—consists, of course, of a mixture of the volatile and of the fixed oils, and the yield is given, by Fluckiger and Hanbury, at 28 per cent of the nuts. It is chiefly imported from Singapore in square or oblong tablets or cakes, and some, recently measured, were found to be about 9½ inches long by 2¼ inches wide, of an orange-brown tint, fragrant and aromatic. The fixed oil, or non-volatile basis, of this "butter" contains several saponifiable fatty acids, *Myristicene* being the most prominent of these.

The method of preparing this "expressed oil" is to bruise the nutmegs and subject them first to the action of steam, and then to place in bags between the tested surfaces of large plates of iron previously heated, and subject them to great pressure, collecting the escaping oil in the usual manner. An important ingredient in the warm plaster and the *Emplastrum Picis* of the British Pharmacopœia, the "expressed" oil, either with or without mixture with *Lin. saponis*, is exceedingly useful as an external application for the reduction of sprains and the amelioration of paralysis, gout, and chronic rheumatism, etc.

The quantity of nutmegs annually imported into England amounts at present to from 640,000 to 660,000 pounds. France is content with something like half as much, and America imports about 470,000 pounds per annum.

The *Myristica sebifera* appears to be indigenous to the Brazils and British Guiana, and it is also found abundantly in Cayenne. It grows to about twice the height of *M. fragrans*, that is to say, 50 or 60 feet in height. The latter is said to contain no starch whatever; but this statement the present writer is able to deny, although the quantity of starch present in this nut is less than in most of the other varieties.

By drying the fruit in the sun, passing through rollers to break the shell, which is subsequently separated, crushing the kernel and throwing it into boiling water, some 29 per cent of fat is obtained, valuable for soap and candle making purposes.

The *M. laurifolia*, of Martinique, is very little known at present. A small specimen was placed in the hands of a well known analyst, who found 34·5 per cent of fat or oil.

M. punctata is chiefly remarkable for being without smell or taste. This variety is used in Brazil—its native habitation.

From the same country as the preceding comes the "ucu-uba," the fruit of *M. officinalis*. The flavor is amygdalaceous, but it has little or no taste; 18 or 20 per cent of fat is yielded upon macerating in hot water, and pressing, and this is much in demand for the purpose of soap and candle making, and as an ointment for the cure of asthma, tumors, and rheumatic affections. It begins to melt at 106° F., and forms a yellow fluid at about 170° F. This fatty matter dissolves in 3·1 parts of ether, 28·1 parts of hot absolute alcohol, but in the cold 105 parts are required to dissolve it.—*Br. C. and Druggist.*

* *Jour. de Pharm.*, 1823, pt. ix., p. 281.

Focal Distance of Spectacle Glasses.

Place the ends of a measure of 30 or 40 inches in length against a smooth wall or other suitable ground, in plain view of some well defined object a few rods distant, as, for instance, a building or window on the opposite side of the street. Then place the edge of your lens on the measure, and move it backward or forward until a spectrum is formed, or in other words, until a clear and distinct outline of the distant object is produced on the ground against which your measure rests. This point will represent sufficiently near for all practical purposes the exact focal distance of the lens, and will correspond in inches with the number on all properly marked convex spectacles.

Boring for Natural Gas at Cleveland, Ohio.

The Cleveland Rolling Mill Company of that city has been drilling for gas on its property in the Eighteenth Ward since October 10, 1884. At the depth of 715 feet a small vein of gas was found, but it was soon exhausted. After passing through the shale the drill entered a vein of limestone, 260 feet in thickness. Below this, hard gray sandstone was encountered. While the drill was pounding in the sandstone at a depth of 1,700 feet, the well suddenly filled with water, which, being pumped out, was found to be strongly impregnated with salt. The drilling was continued until a depth of 1,985 feet had been reached, when pure rock salt was found. This vein was 169 feet in thickness, and it required 36 hours to drill through it. The drillers were not in search of salt, but gas, and they continued with the work. The big salt vein was encountered about a month ago. Two weeks later, after drilling through a considerable amount of rock, another but smaller vein was encountered. The drill was still driven downward until it had reached a depth of 2,680 feet, and the drillers were treated to another surprise. This time they found petroleum. Evidences of oil were found in the shape of a peculiar odor about the borings. The drill was passing through very hard rock, and it therefore proceeded very slowly. Every time the sand pump was put down into the well it was filled with oil and water, and several barrels of petroleum were taken out in that manner. The oil is said to be of very fine quality. What has already been found seems to have trickled through the rock from a pocket near the well. No gas has been found since the drill passed below 1,000 feet. It is now producing about one barrel of oil daily. The hole has reached a depth of 2,700 feet, and according to the *American Gas Light Journal*, there are slight indications of gas, but it has not yet been discovered in paying quantities.

How Bees Predict the Weather.

No. 17 of *Die Natur* contains an article by Herr Emmerig, of Lauingen, on German bees as storm warners. From numerous observations, the writer advances tentatively the theory that, on the approach of thunder storms, bees, otherwise gentle and harmless, become excited and exceedingly irritable, and will at once attack any one, even their usual attendant, approaching their hives. A succession of instances are given in which the barometer and hygrometer foretold a storm, the bees remaining quiet, and no storm occurred; or the instruments gave no intimation of a storm, but the bees for hours before were irritable, and the storm came. He concludes, therefore, that the conduct of bees is a trustworthy indication whether a storm is impending over a certain district or not, and that, whatever the appearances, if bees are still, one need not fear a storm.

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ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. Joshua H. Dymond, of Carbondale, Kan. It is designed to couple automatically, the two ends of the link being alike, and the drawheads alike at both ends of each car, and so made that either end of any link will engage either end of any car.

A steam boiler has been patented by Mr. George G. Tindall, of Oakland, Cal. Combined with vertical spaced walls of a firebox is a special construction of downward curved crown sheet, with other novel features, making a boiler particularly adapted for burning straw and other light substances, such as needed for operating thrashing machines and for similar uses.

A rotary engine has been patented by Mr. Dennis McColgan, of Butte City, Montana Ter. This invention covers improvements on a former patented invention of the same inventor, in an engine where a wheel having a U-shaped groove in its face forms the cylinder or steamway, the present improvements being in contrivances of the valve gear, ports, and reversing valves, with various other details.

A metallic railway tie and fastener has been patented by Mr. Robert R. Shepard, of New York city. The tie is hollow, and of an inverted trough-like construction, carrying raised lips to receive the base flanges of the rails, and opposite these lips are key hole apertures to hold a detachable locking key or button to hold the rail down to its place on the tie, with facility for releasing the rail if desired to take it up.

AGRICULTURAL INVENTIONS.

A comb for grass seed harvesters has been patented by Mr. Jacob I. C. Naff, of Winchester, Ky. The teeth are adjustable to adapt the comb to seed at different stages of ripeners and to different kinds of grass, and the construction is intended to secure a strong and good connection of the teeth to the comb, and facilitate the manufacture.

A harrow has been patented by Messrs. Conrad Fischer and Louis Grother, of Brownsville, Mo. The harrow frame is made of a series of bars with open-sided sockets to receive the teeth, braces with their ends bent at right angles closing the open sides of the sockets, the bevel of the sockets permitting a different inclination of the teeth when the harrow is drawn in a reverse direction.

MISCELLANEOUS INVENTIONS.

A note and memorandum book has been patented by Mr. Adolph Pester, of Brooklyn, N. Y. It is a book which may also be used for a toilet, sewing, or other case, and has a flap to rest on the front, with a pocket or loop for receiving a pencil, scissors, rules, or similar article.

A wrench has been patented by Mr. John McLean, of Camden, Ala. This invention covers a special construction of wrench convenient to use in situations where little room is afforded for access to nuts, bolts, or other work requiring to be turned or held, the implement being simple and durable.

A calendar cuff button has been patented by Mr. Garcia Monteiro, of New Bedford, Mass. It has a longitudinal box or shell with two or more transverse slots, and in the box are strips and spindles to be turned by a key, making an adjustable device for showing dates through slots in the button.

A smut mill has been patented by Mr. Jacob Fitz, of Hanover, Pa. This invention covers a novel construction of a mill to first violently agitate the grain and scour the kernels, and then to retard its progress through the mill that it may be thoroughly cleaned and the dust withdrawn.

A medical compound has been patented by Mr. John O'Flaherty, of Lachine, Quebec, Canada. It is composed of powdered sulphur and hierapicra, in certain proportions, and to be applied in a definitely stated manner, for the treatment of rheumatism, gout, lumbago, sciatica, and other similar affections.

A bicycle handle has been patented by Mr. Robert Rodes, Jr., of Nashville, Tenn. The construction is such that the handles can be swung upward and together by the forward movement of the rider when he is thrown forward by accident, thus permitting the rider to jump from the front of his bicycle.

A sewing machine cabinet has been patented by Mr. William H. Hiteshew, of Peru, Ind. It is so arranged and constructed that when the top of the cabinet is closed the machine is automatically lowered through an opening in the top of the cabinet, and is raised automatically out of the cabinet when the top is raised.

A head rest has been patented by Mr. Charles E. Neeley, of Gurdon, Ark. It consists of a head piece upholstered on one side and having on the other side a mirror, there being also a clamping device adapted to be secured to the back of a railway car seat or other chair, in which the head piece may be adjustably held.

A cant hook has been patented by Messrs. Harry C. Crawford and Edwin V. Mundy, of Duluth, Minn. This invention consists principally in making the handle socket in two parts arranged to be clamped to the handle by suitable clamps or ferrules, so that should the handle break a new one can be easily inserted.

A magazine spring gun has been patented by Mr. Amedee J. Benjamin, of Valley Falls, R. I. The barrel and magazine have guide slots in the sides, with a crosshead fitted to slide therein, the object being to provide an improved toy gun adapted to shoot several arrows or darts without reloading after each shot.

A chain socket has been patented by Mr. James F. Thomas, of Denver, Col. An internally screw-threaded socket has a notch on its outer end, with other novel features, making a socket to be used on furniture for holding the ends of chair rounds in place, also to hold drawer pulls and knobs, and for other like uses.

A thill coupling has been patented by Messrs. Major Hall and John C. Ryan, of St. Paul, Minn. This invention consists in a packing formed of an inner elastic block or deadener and an outer metallic casing, with a clamping or adjusting screw to take up any slackness in the joints, and free the thill connections from annoying rattling of the parts.

A bow-facing oar has been patented by Mr. Marcus M. Clark, of Vermont, Ill. Combined with an oar and lever is a plate or rod forming a curved guide for the fulcrum of the lever, with crossed rods connecting the lever and oar at opposite sides of the fulcrum, so that a person propelling the boat by oar can face the bow.

A painter's sander has been patented by Mr. Joseph P. Ryan, of New York city. It comprises a box with perforated bottom, an air chute and sand chute of special construction, with other novel features, whereby sanding can be done above and below the level of the sander, or at either side, without moving the sander from a horizontal position.

Checks, drafts, and other money orders form the subject of a patent issued to Mr. William T. Doremus, of Flatbush, N. Y. This invention provides a special form of blank so spaced and numbered that when a check or draft is properly filled out therein it cannot be readily raised or made to represent a larger sum than that for which it is drawn.

A gas regulator has been patented by Mr. Joseph D. West, of East Orange, N. J. This invention covers a novel construction intended to equalize the pressure of gas at the point of consumption, whether the gas in the supply pipe be under heavy or light pressure, and whether the gas is being consumed at one or more burners in the same service pipe.

A churn has been patented by Messrs. Frank A. Houck and Thomas C. Carter, of Holden, Mo. The invention consists principally in attaching the arms of the upper dasher to an upright plate that revolves around the main upright shaft and agitates the cream at the center of the churn, two dashers being used, revolving in opposite directions.

A wagon brake has been patented by Mr. Albert K. Barmore, of Milano, Texas. It is so constructed as to be operated by a few short strokes of a lever, which tighten a cord until the brake block exerts the required pressure, when a catch holds the brake lever in position until released, the device being easily made and applicable to all kinds of vehicles.

A paper keg or cask has been patented by Mr. Charles H. Wickersham, of Pottstown, Pa. The shell is formed of a sheet of board notched at its four corners and bent into cylindrical form, the edges of the board between the notches being overlapped and secured together, and end caps fitting over the ends of the cylinder, making a cask adapted for holding nails, etc.

A windmill has been patented by Mr. Pha Tefft, of Saguache, Col. Its sails or vanes are pivoted eccentrically to radial arms of a vertical shaft, with means to balance and stay chains to hold them, and rods extending down the shaft to be manipulated from the ground to stop and start the mill, the object being to make a simple, efficient, and durable mill.

A piano stool has been patented by Mr. Claude W. Blackburn, of Chicago, Ill. This invention covers a special construction intended to facilitate the rapid adjustment of the seat to the desired height, for which it is only necessary to lift it with the hands, when it is automatically held where placed, the stool being cheap, strong, and not liable to get out of order.

A metal mould has been patented by Mr. Thomas O. Bennett, of Atlantic Mine, Mich. It has fixed sectional portions with beveled lips, with yielding sections forming a portion of the sides, with ends beveled to fit the beveled lips, with springs to control the yielding sections, making metal moulds adapted for casting a variety of articles of different construction and shape.

A carpet stretcher has been patented by Mr. John J. Taylor, 2d, of Warren, Pa. A grooved bar holds a sliding rack, the front end of the rack being pivoted on the bar, while there is a U-shaped frame with a wire or rod as a fulcrum for a lever engaging with the teeth of the rack, and used for moving the rack in the direction of its length, the device being easily operated and folding compactly when not in use.

A repeating firearm has been patented by Mr. Athanase Chuchu, of Bahia, Brazil. Combined with a stock and a barrel hinged thereto is a plate hinged on the breech end of the barrel to prevent the cartridges from falling out, the plate having a single aperture through which the firing pin can strike the barrel, making a pistol occupying but little space in the pocket and presenting advantages similar to those of a revolver.

Knockdown furniture is the subject of a patent issued to Mr. Joseph B. Brolaski, of St. Louis, Mo. This invention is an improvement on a former patented invention of the same inventor, and is intended for the manufacture of various articles of household furniture, as bureaus, washstands, sideboards, kitchen safes, desks, etc., which are by this invention so constructed that they can be folded very compactly for transportation, can be erected and taken apart easily, and stand rigidly and firmly when set up.

Mr. Lazarus Goldenberg, 219 E. 30th Street, New York city, is the patentee of a portable electric light arrangement for lighting rooms or buildings temporarily by electricity. The invention consists principally of temporary or false moulding supports made in sections, and provided with electric conductors which are held along the walls at the ceiling by temporary pillars. Entire buildings or special rooms, such as parlors, ballrooms, churches, etc., may thus be provided with temporary electric lighting appliance for special occasions, which may be quickly put in place, and which, besides furnishing the electric light, will also ornament the room, and will not injure the ceilings, walls, or floor, and can be readily removed after use.

A drip cup for lamps has been patented by Mr. Edward A. Condit, of Hoboken, N. J. It is a cap with internal staples and a bail to attach to a loop below the lamp bracket or lamp chandeliers, to obviate the difficulty caused by overflows or dripping.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Minerals sent for examination should be distinctly marked or labeled.

(1) D. S. M. asks: What is the proper test for iron in water? A. Concentrate the water by heating to comparatively small bulk, then add a few drops of potassium ferrocyanide. A blue coloration is indicative of iron salts. Iron is not ordinarily objectionable in drinking water, but is an excellent tonic.

(2) H. K. writes: In your directions for making artificial marble, June 13, query 2, you say, "Soak plaster of Paris in a solution of alum." Can you state the process more explicitly? A. A solution of alum is made by dissolving the alum in sufficient water, and then plaster of Paris is put right into the vessel containing the liquid. It is then so mixed that the solution reaches all portions of the plaster. Next, as described, it is baked. You will find on page 369 of the same issue of the SCIENTIFIC AMERICAN a similar process for hardening plaster. 2. Can you also give some composition for imitating bronze on plaster cast? A. The imitation bronze is prepared as follows: To a solution of soda soap in linseed oil, cleared by straining, add a mixture of 4 pints of copper sulphate and 1 pint iron sulphate solution, which precipitates a metallic soap of a peculiar bronze hue; wash with cold water, strain, and dry to powder. In applying it, 3 pounds pure linseed oil are boiled with 12 ounces finely powdered litharge, strain through a coarse canvas cloth and allow to stand until clear; 15 ounces of this soap varnish mixed with 12 ounces metallic soap powder (previously described) and 5 ounces fine white wax are to be melted together at a gentle heat, in a porcelain basin, by means of a water bath, and allowed to remain for a time in a melted state, to expel any moisture that it may contain; it is then applied with a brush to the surface of the plaster previously heated to 200° Fah., being careful to lay it on smoothly and without filling up any small indentations of the plaster design. Place it for a few days in a cool place; and as soon as the smell of the soap varnish has gone off, rub the surface with a linen rag or cotton wool, and variegated with a few streaks of metal powder or shell gold.

(3) M. V. O. writes: A man has been going about here, selling a gold wash; it is a perfectly clear liquid, like water, and the article you wish to gild, be it silver, nickel, or brass, is immersed in this liquid, having a piece of zinc first wrapped around it, remaining in the bath five minutes; after taking out, it is rubbed with a kind of white powder he uses for the purpose, and then washed in pure water, leaving every appearance of gold. Will you inform me what this wash and powder are? A. Metallic surfaces are gilt by rubbing in the following mixture: Chloride of gold dissolved in pure water 36 parts, mixed with a solution of cyanide of potassium (poisonous) 60 parts, in pure water, shake well and set by for 15 minutes, then filter. This liquid is thickened with a powder composed of prepared chalk 100 parts, cream of tartar 5 parts. The foregoing can be used without zinc, and yields results identical with the preparation described by you.

(4) J. R. asks how to make diamond ink to write on glass. A. Diamond ink is made from ammonium fluoride dissolved in water and mixed with three times its weight of barium sulphate.

(5) F. W. C. asks the composition of the sizing which is used on the back of glass windows for applying gold leaf. A. Albumen or white of egg is used. Groot's brilliant sizing, made in Chicago, is a preparation considered unsurpassed for this purpose. 2. Is the dark color of oil that has been used on bearings due to some chemical action, or to minute particles of metal being suspended in it? A. The color is due to minute particles of metal suspended in the oil.

(6) C. T. P. asks: What is the easiest and most practical way to manufacture hydrogen peroxide? A. You will find the outlines of the process in general use given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 184, under the title of "Peroxide of Hydrogen." The details are kept secret, and we understand that the commercial manufacture of this substance is a difficult operation. If but a small quantity of the substance is desired, it will be found much more economical to buy it. See also SCIENTIFIC AMERICAN SUPPLEMENT, No. 339. 2. What is the best cement to make heavy Manila paper adhere to wood or a planed board? A. A thin solution of glue or a liquid glue will answer your purpose. The latter is readily prepared by softening 10 parts best glue in 100 parts warm water, and then adding slowly 5½ to 6 parts nitric acid, and finally 6 parts powdered lead sulphate. The latter is used in order to impart to it a white color.

(7) J. Y. G.—For the preservation of insects a good plan is to perforate their bodies once or twice with a long pin dipped in a strong solution of corrosive sublimate. If the case containing the specimens is full, or not likely to be disturbed, the insects and

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cases are cleaned as thoroughly as possible, and then the insides of the cases are painted over with a brush dipped into a solution of the sublimate. A few pieces of camphor are placed at the bottom of the case, the lid is fixed on, and strips of paper pasted over the crevices. We would recommend you Mr. J. H. Batly's recent work on "Practical Taxidermy and House Decoration," which we can mail for $1.50.

(8) L. S. asks (1) for a recipe for making an efficient and cheap tooth powder. A.

Prepared chalk..... ....1 ounce.
Powdered borax..... ½ "
Powdered myrrh..... ¼ "
Powdered orris..... ¼ "
Mix and sift through fine cloth.

2. A recipe for making a good lady's shoe dressing? A. Ivory black in fine powder 1 pound, molasses ¾ pound, sweet oil 2 ounces, beer and vinegar of each 1 pint. Rub together the first three until the oil be perfectly killed, then add the beer and vinegar. 3. Recipe for making a good roach and vermin destroyer? A. Boil 1 ounce poke root in 1 pint water until the strength is exhausted. Mix the decoction with molasses, and spread it on plates in localities infested by vermin. 4. A recipe for making a No. 1 grease eradicator? A. Soft-soap and fuller's earth, of each ½ pound, beat well together in a mortar, and form into cakes. The spot first moistened with water is rubbed with the cake and allowed to dry, when it is well rubbed with a little warm water and rinsed or rubbed off clean. 5. A recipe for making a good polishing paste for metals, such as gold, silver, copper, brass, etc.? A. See answer to query 20, in SCIENTIFIC AMERICAN for May 2, 1885.

(9) J. E. Y. asks: 1. What can I cement the edges of writing paper together with, to make them into pads as printers do? A. A quarter of an ounce crude gutta percha dissolved in carbon disulphide to the consistency of mucilage. Apply to the edges of the paper where required. 2. What makes a good cement for metal that is used for holding kerosene? A. Boil 3 parts of resin and 1 of caustic soda in 5 of water. This composition forms a soap which, when mixed with half its weight of plaster of Paris, sets firmly in about three-quarters of an hour.

(10) A. G. A., Jr.—The rate of progress of glaciers, dependent upon various conditions, is no more uniform than that of rivers. It can in no case be correctly estimated except by observations extending over many years. Thus, for instance, the progress of the glacier of the Aar was for a certain period of time 250 feet per annum, and during another period 550 feet per annum. De la Beche gives 200 yards a year as the motion of the Mer de Glace; "400 feet and 40 feet are both given as the rate of motion of the Mer de Glace." If you will consult Tyndall's "The Glaciers of the Alps," you will find in that book the explanation of the entire subject. There is probably no information that is reliable on record concerning the glaciers of Alaska. See also the "Causes of the Motion of Glaciers," SCIENTIFIC AMERICAN SUPPLEMENT, No. 398.

(11) L. K.—There are various plans of making mustard, thus: Soyer's is described as follows: Steep mustard seed in twice its bulk of distilled vinegar for 8 days, grind to a paste and put it into pots, thrusting a red hot poker into each. Moutarde a l'Estragon: Gently dry 1 pound black mustard seed, then powder it fine, and mix it with 2 ounces salt and sufficient tarragon vinegar to make a paste. In a similar way are prepared several other mustards, by employing vinegars flavored with the respective substances, or walnut or mushroom catsup or the liquor of the richer pickles in proportions to suit. Suitable mortars or grinding apparatus can be procured through any jobber in hardware utensils or druggists' sundries, provided only the smallest articles are desired, otherwise they will have to be made specially.

(12) W. S. asks: 1. What is the best thing to use to soften paper or pulp board to render it fit for pressing into useful shapes, so as to retain its form when dried? A. The pulp is soaked in water and then put right into the heating engine, and there mixed up with the stock. 2. Can it be rendered waterproof at the same time, or what is the best method of waterproofing? A. There is no process of so treating paper as to make it entirely waterproof. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 39 and 96, describe processes for this purpose.

(13) J. W. B. asks the most approved—tested—method of bottling extract of herbs, by hand, so as to prevent it becoming sour after a few weeks or months, without using alcohol. The addition of 25 per cent of glycerine can be employed with safety. Otherwise heat the bottles after they are filled by placing them in boiling water and cook; as they cool a vacuum will be formed, so that the air will not come in contact with the herbs at all.

(14) L. S.—You cannot make a good journal box without tin; 2 ounces tin, 1 ounce zinc, to 1 pound of copper makes an excellent box for wear. Antimony and lead make a poor alloy; antimony and tin make a good soft box.

(15) F. K. asks: Why is it that a heavier float, raft, or coal barge will float faster, or farther in a day, or any length of time, than a lighter one, neither being aided by any motive power or sail? A. It is well known that the swiftest part of the current of a river is not at the top, but somewhere between the top and bottom. The deep laden barge catches the swift undercurrent, and floats faster than a shallow barge.

(16) W. B. H. asks for a plating to apply to the reflector of a dark lantern (tin) without removing the reflector from the lantern. A. Apply the following paste with a rag to the tin; it will form a silver coating: Silver nitrate 1 part, cyanide of potassium (poisonous) 3 parts, with water sufficient to form a paste.

(17) F. P. L. R. desires a good prescription to be taken for internal piles, where they are high up; also a good injection to keep in over night, and the amount to be used of the injection. A. Pulverize in a mortar, and mix thoroughly, 1 ounce each of cream of tartar, jalap, senna, flowers of sulphur, and golden seal, and ½ ounce saltpeter. Dose, a teaspoonful three times a day. For external use: Boil some of the inner bark of white oak in water, and strain; evaporate to a thick extract. To ½ pint of this extract add ½ pint of oil rendered from old strong bacon. Simmer together till mixed, and let cool. Apply with the finger inside the rectum every night and until cured.

(18) R. O. E. L.—Iron pipe is universally used for conveying the brine in cold cellars and for producing cold in brine vats. If kept free from atmospheric influence, it is the best material available. If a machine is to be laid up for a few months, leave the brine in or on the pipes.

(19) U. D. asks: What is the best treatment for catarrh in the throat (post-nasal catarrh)? A. You will find in SCIENTIFIC AMERICAN SUPPLEMENT, No. 262, an article on "Nasal Catarrh," by Dr. F. H. Bosworth, to which we refer you. Dr. Dudley Reynolds, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 84, writes very fully on the character and treatment of catarrh. See also "A Cure for Catarrh," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 216. The best thing to do, however, is to consult some competent physician.

(20) D. C. H.—If a lightning rod has a good ground, the more numerous its connections with the building the better. Insulators are a positive detriment. A lightning rod should be connected with the tin roof, if the building has one, the gutter, the leaders, and all the metal pipes in the house.

(21) W. W. Q. asks: 1. What is the composition used in the porous cups of the Leclanche battery? A. Granulated black oxide of manganese. In some batteries of this class granulated carbon is mixed with the manganese. 2. What is the best battery for silver and gold plating? A. For plating on a small scale use Smee's; for large work use the Bunsen bichromate.

(22) G. L. C. writes: We wish to get a clockwork motor, to pump an organ. Can such a motor be procured? A. We know of no clockwork motor that would be likely to meet your wants. Spring or weight motors are not much used, as it takes more labor to wind the machine than is required to do the work by the direct application of the power. One would have to be specially made for your purpose, which a good mechanic could do according to the situation.

(23) D. A. F. writes: With a center gas light, 6 feet from large mirror, will room be any lighter on account of reflection of light in mirror? A. The light reflected by the mirror will add something to the light of the room, as, if the mirror were not there, more or less of the light would be absorbed by the wall.

(24) S. T. W. writes: I have built a canvas canoe, and I want to cover it with two thicknesses of Manila paper. I want to find a waterproof glue or a composition of pitch and something else to stick the paper to the canvas. A. Use the following: Fuse together equal parts or pitch and gutta percha, and to this add about 2 parts of linseed oil containing 5 parts of litharge. Continue the heat until the ingredients are uniformly commingled. Apply warm.

(25) G. J. S.—For a sand blast the chamber containing the sand should be connected with the pressure pipe and closed tight. The inlet pipe should be at an acute angle with the blast pipe, so that the sand will flow freely into the blast.

(26) X.—The principle governing the pitching of a curved ball is the same for any distance; but when a person gets familiar with the peculiar motion for a given distance, he cannot give the same curve for any other distance without special practice for that distance. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 423, on Base Ball Science.

(27) W. G.—A little salt in the water for hardening files is commonly used. The heat should suit the quality of the steel. The lowest heat at which the file can be hardened is the proper one. This can only be ascertained by trial. Acid does not destroy temper, but is sometimes used to sharpen old files.

(28) E. L. P.—The hard baking japan for iron work is sold by the varnish makers. It is put on with a brush thinly, and baked in an oven at about 260°; 2 coats is generally sufficient. Cannot give the formulæ for the best. Better buy it.

(29) F. J. R. asks: What acid is used to bring out the date on old copper pennies? A. By heating copper coins gradually, it is said that the inscription will in almost all cases make its appearance. Coins can be quickly cleaned by immersion in strong nitric acid and immediately washing in water. If very dirty or corroded with verdigris, it is better to give them a rubbing with the following: ½ ounce pure potassium bichromate, 1 ounce sulphuric acid, 1 ounce nitric acid. Rub over, wash with water, wipe dry, and polish with rottenstone or chalk.

(30) W. S. desires the best means of fusing or dissolving gum amber so as to make that varnish. A. Six pounds of fine picked, very pale, transparent amber are cautiously heated in an iron pot, and as soon as it becomes semi-liquid, 2 gallons of pale boiled oil, previously made hot, is very gradually stirred in, and the whole thoroughly blended. This operation is one of considerable delicacy, and requires experience and skill. By mixing it with four gallons of turpentine, a varnish is obtained that will work free, will flow well, is durable, and becomes very hard.

(31) H. L. asks: What is considered best for heaves in horses? A. Balsam of fir and balsam of copaiba, four ounces each, and mixed with calcined magnesia sufficiently thick to make it into balls; and give a middling sized ball night and morning for a week or ten days.

(32) E. B. B. asks: 1. Can you give me the percentage of starch and sugar in ale and beer? A. The percentage of sugar contained in ale and beer varies between 2 and 3 per cent. Among a number of analyses made of beer in this city we find the percentage of sugar in one sample to be 2·64, while in another it was only 2·20. 2. Is there any malt liquor which has no starch or sugar in it? A. Malt liquors by definition are such in which the grain has become sweet from the conversion of the starch into sugar by an incipient growth or germination artificially produced, called malting.

(33) E. M. K. asks how to work over butter that has become rancid from age and oiling. A. Rancid butter may be restored, or in all cases greatly improved, by melting it in a water bath with some fresh burnt and coarsely powdered animal charcoal (which has been thoroughly freed from dust by sifting), and straining it through clean flannel. A better and less troublesome method is to well wash the butter first with some good new milk, and next with cold spring water. Butyric acid, on the presence of which rancidity depends, is freely soluble in fresh milk.

(34) A. A. S. asks how to make or where to get the kind of black crayons used by rapid crayon artists on the stage. A. The crayons consist of ordinary charcoal, and can be purchased from any house dealing in artists' materials. 2. How luminous paint is made from phosphorus. A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 249. See also Balmain's Luminous Paint, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 229.

(35) R. E. M. B. writes: 1. I want a good waterproof varnish for fine fishing rods. A. Let 4 ounces India rubber in small pieces soften in 8 ounces of oil of turpentine, then add 2 pounds of boiled oil, and boil for two hours over a slow fire. When dissolved, add 6 pounds of boiled linseed oil and 1 pound of litharge, and boil until an even liquid is obtained. To be applied warm. 2. What preparation will best polish German silver trimmings on a rod, and prevent their turning brassy looking? A. Use the polishing paste described in answer to query 20, in SCIENTIFIC AMERICAN for May, 2, 1885.

(36) V. J. T. asks: How can I make the color stay in a meerschaum pipe, so it will not come out in white spots when it gets hot? A. A raw meerschaum pipe would not acquire the rich color which is the smoker's delight, for the oil of tobacco absorbed by the pipe would penetrate the bowl and evaporate. Accordingly, the pipe is boiled in a preparation of wax, which is absorbed, and a thin coating of wax is held on the surface of the pipe and made to take a high polish. Under the wax is retained the oil of tobacco, which is absorbed by the pipe, and its hue grows darker in proportion to the tobacco used. A meerschaum pipe at first should be smoked very slowly, and before a second bowlful is lighted the pipe should cool off. This is to keep the wax as far up on the bowl as possible, and rapid smoking will overheat it, driving the wax off and leaving the pipe dry and raw. It is probable that the wax referred to in the foregoing has been burnt away in your pipe, and hence the white spots.

(37) W. P. H. asks: How many cubic feet for air chamber of compressed air will be required to make one horse power for one hour duration, without adding to the stored amount of compressed air in the air chamber, at the time of starting the engine, the speed of engine to remain the same through the time specified? A. For 1 hour's work equal to 1 horse power, you will require, for the operation of the engine and necessary leakages, 450 cubic feet of air per hour at 30 pounds pressure. You will require storage for 675 cubic feet at 60 pounds pressure to start with, which will run your engine for 1 hour, leaving 30 pounds pressure in the tank at the end of the hour's work. 2. What is the cost of compressed air per horse power? A. It costs more to compress air for power, if done by steam, than the value of the derived air power, by a very large percentage.

(38) B. G. C. asks if a person standing on the bow of a vessel should jump in an opposite direction to that in which the vessel is moving, would the said person make a longer jump than he would if the vessel was stationary? A. No.

(39) L. C. F. writes: I have a three wheeled Sheffield velocipede hand car which I have occasion to use almost continually. Could the car be propelled by a small steam engine or an electric motor, and the car still be readily put on and off track by one person? Present weight of car is some 150 pounds, and light running therefore would not require much power to run it. A. We know of no motor that you could apply to your hand car without adding so much weight as to render it impossible for one person to handle it. There are steam engines in the market which would readily drive it, but they would weigh perhaps 300 pounds, besides the water and fuel. You will find an electric motor very expensive and troublesome.

(40) W. F. asks the best kind of oil to put on engines, lathes, and other kinds of machinery, highly polished, to keep it looking bright all the time. A. We know of nothing better than good cylinder oil melted with leaf tallow, about equal parts; rub the bright parts with the mixture on a rag, leaving but very little oil on the surface. To keep the work looking well and clean, it should be wiped at least twice a week. The dust that lodges upon the surface of oiled work makes it appear dirty. You cannot keep machinery clean without work.

(41) E. A. writes: I have shaft with 2·8 foot wheels, one on each end of shaft, fastened to run on straight track parallel; another, wheel, 15 inches in diameter, is fastened in center of same shaft, with central rail raised up to the center wheel. In moving, does the center wheel slip or not on center rail? Also, a box car moving on a short curve, does the inside or outside wheel do the sliding? A. The small wheel will slide along the center rail if the pressure of the three wheels is alike on the three rails. There is a possibility of the large wheels slipping with a preponderance of pressure on the center wheel. The slipping of wheels does not admit of a positively theoretical answer, but an inspection of the rails at a curve should decide the question practically. The rail that has the greatest slip will be found to be worn and abraded.

(42) F. P. (Mexico) writes: Our cotton, as taken from the field before ginning, is stowed away in a large warehouse, and perhaps remains there some six weeks. We find it liable to heat, which makes the color brown, besides the great danger from fire. How can I ventilate a room full of unginned cotton? A. For preventing the heating of unginned cotton in warehouse, make the floor open and raised above the ground, so that there should be a free circulation of air under the floor and through the open floor to the cotton. The strips for such a floor may be 1½ inches thick and 2 inches wide, laid ¾ inch apart. If a floor is already laid solid, and it is not desirable to alter it, a lattice or open floor may be laid over the solid floor by laying strips 3x4 in. on edge, so there shall be continuous passage for air between them clear across the building, and on these strips lay the open floor. Make openings on opposite sides of the warehouse for every passage.

(43) E. M. D. asks: What is the liquid composed of that barbers use for shampooing? A. Dissolve 1 ounce potassium carbonate (salts of tartar) in 1 quart soft water; sprinkle freely on the head, and rub well till a lather is formed; wash off with clean water.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

B. F. W.—No. 1 consists of iron and copper sulphides, and has the appearance of being a furnace product. No. 2 is a piece of spiegeleisen, a variety of pig iron containing manganese. They have no direct value. —M. C. H.—The powder contains iron and sulphur. Apparently it is the mineral copiapite. To positively determine what it is and its value would require a quantitative analysis. This would cost you $12.00.

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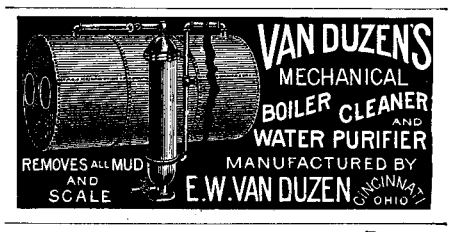

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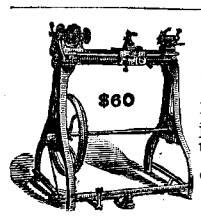

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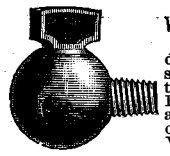

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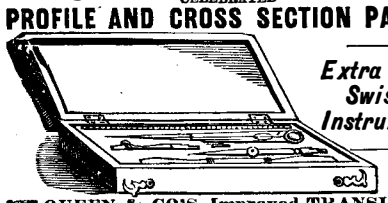

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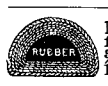

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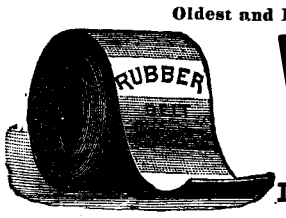

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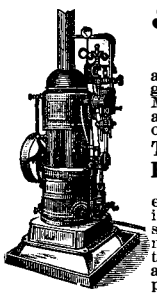

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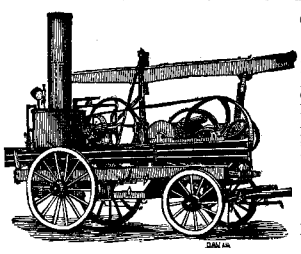

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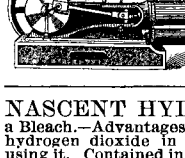

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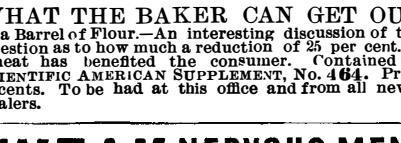

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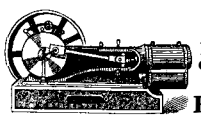

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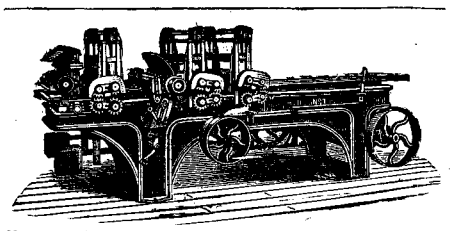

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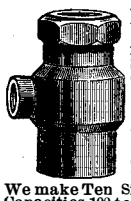

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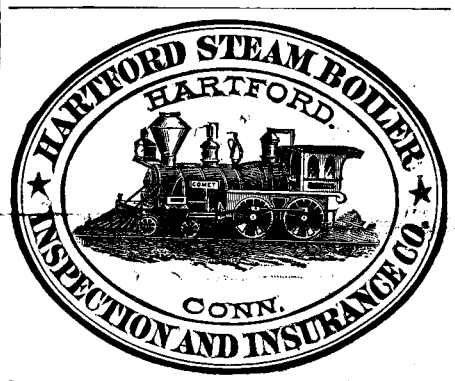

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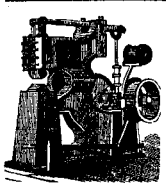

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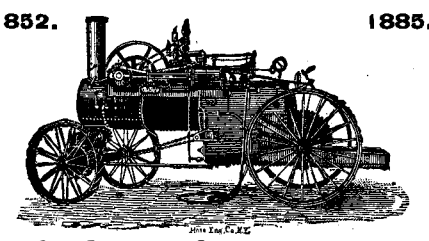

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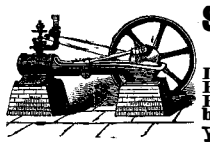

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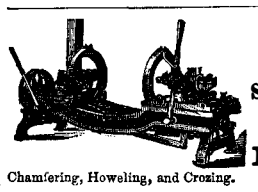

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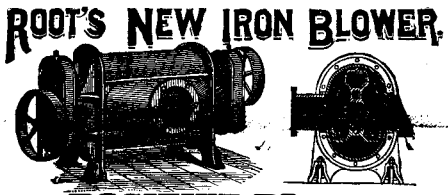

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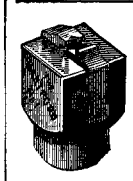

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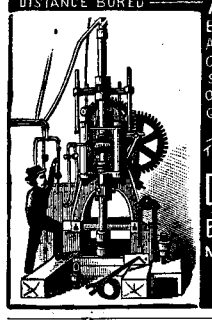

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